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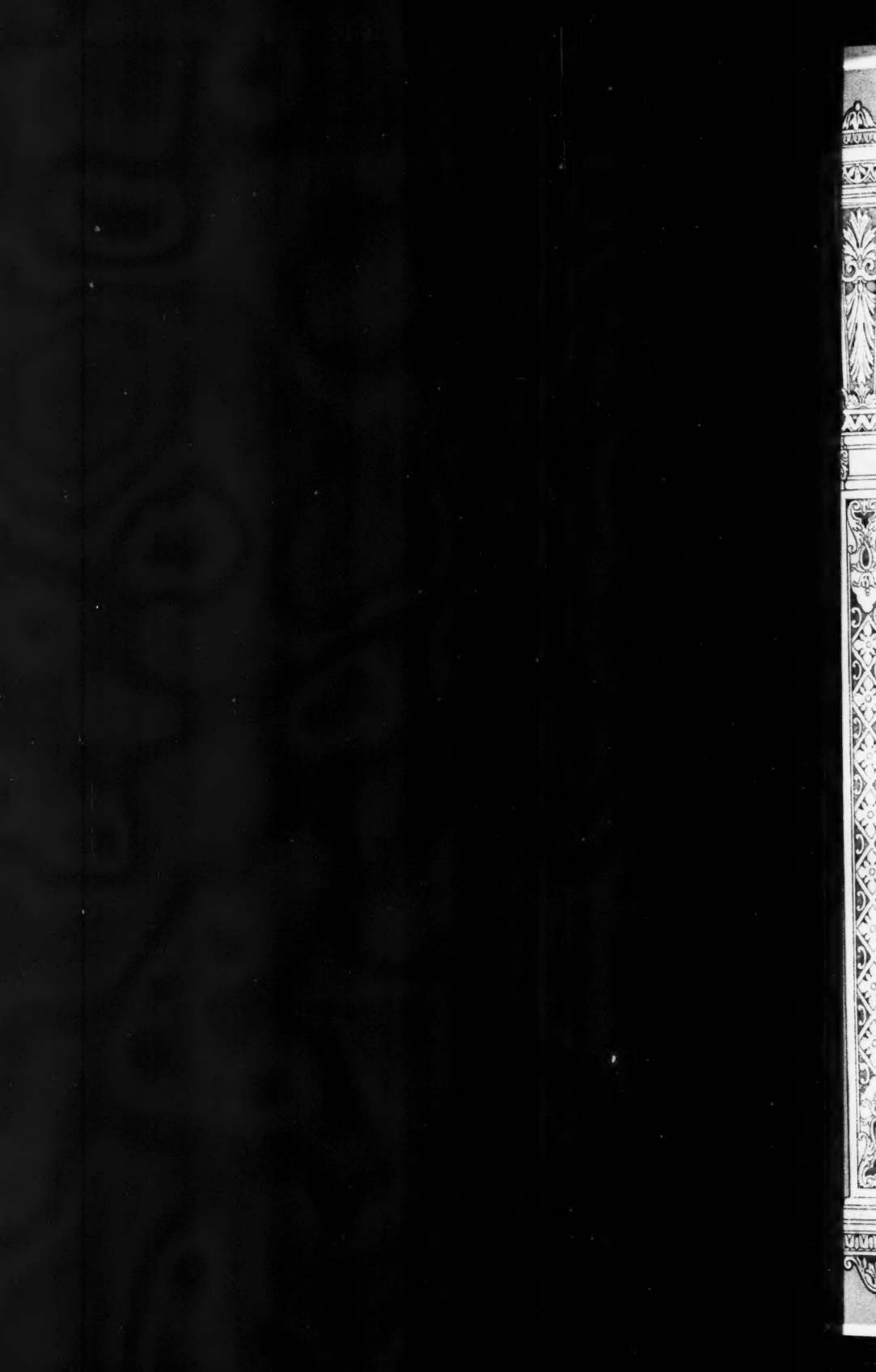

JANUARY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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1923

John Sayre Marshall—*Frontispiece*
Bone Surgery in Cleft Palate—*Brophy*
Human Saliva—*Ferris*
Dental Education in Japan—*Chiwaki*
Omaha Dental Dispensary—*Bruening*
Permeability of Enamel—*Bodecker*
Preparation of Mouth for Prosthetist—*Gardner*
Private Dental Library—*Wilson*
Starch Digestion in Mouth—*Hartzell*
Relations of Specialists and General Practitioners—*Noyes*
What of 1923?—*Editorial*
Medical and Dental News
(A New Department)
Index to Guaranteed Advertisements, A-69

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CONTENTS

John Sayre Marshall, M.D., Sc.D., F.A.C.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

Bone Surgery Essential in the Treatment of Complete Cleft Palate.
By Truman W. Brophy, M.D., D.D.S., LL.D., Sc.D., F.A.C.S., F.A.C.D., O.I. (France) 3

Physiological and Pathological Variations in the Composition of Human Saliva.
By Henry C. Ferris, D.D.S., and E. E. Smith, Ph.D., M.D., with Collaboration of E. V. Graves 19

Dental Education in Japan.
By Dr. Morinosuke Chiwaki. 53

The Omaha Free Dental Dispensary for Children.
By Edward H. Bruening, D.D.S. 58

Permeability of the Enamel in Relation to Stains.
By Charles F. Bodecker, D.D.S. 60

Preparation of the Mouth for the Prosthetist From the Surgical Standpoint.
By Boyd S. Gardner, D.D.S. 64

The Private Dental Library.
By Harris R. C. Wilson, D.D.S. 67

Showing the Possibilities of Starch Digestion in the Mouth.
By Thomas B. Hartzell, M.D., D.M.D., F.A.C.D. 68

The Mutual Relations of Specialists and General Practitioners of Dentistry.
By Edmund Noyes, D.D.S. 72

EDITORIAL DEPARTMENT

What of 1923? 74
A Tribute to Our Friend the Dentist 76
Obituary (John Sayre Marshall) 77

NEWS DEPARTMENT

Medical and Dental News 78-84

ANNOUNCEMENTS

Calendar of Meetings (National, State).—Pennsylvania State Dental Society.—Virginia-North Carolina State Dental Meeting.—Fortieth Annual Meeting of Minnesota State Dental Association.—Creighton Dental Alumni.—New Jersey State Dental Society.—Reduced Fares to the Chicago Component Meeting.—Resolutions on Death of Dr. Glenn A. Wilgus.—Dental Corps Orders from War Department 85-90

ADVERTISING DEPARTMENT

Index to Guaranteed Advertisements A-69
Classified Section A-64, A-65

JOHN SAYRE MARSHALL, M.D., Sc.D., F.A.C.S., San Francisco, California
1846–1922

THE JOURNAL
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Original Communications

BONE SURGERY ESSENTIAL IN THE TREATMENT OF COMPLETE CLEFT PALATE

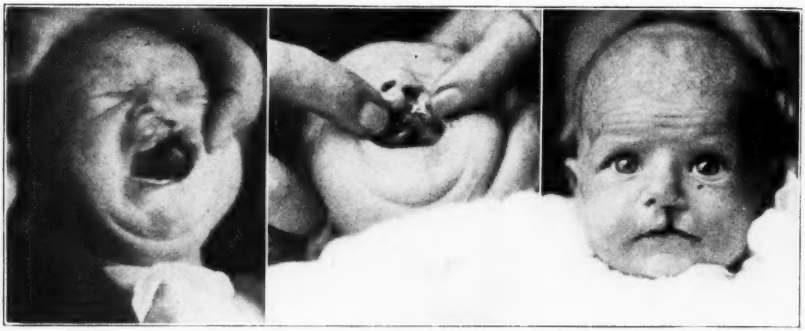
By TRUMAN W. BROPHY, M.D., D.D.S., LL.D., Sc.D., F.A.C.S., F.A.C.D., O.I. (France), Chicago, Illinois

(Read before the American Dental Association, Los Angeles, California, July 17-21, 1922)

A WELL known editor of a medical journal recently declared that the subject of cleft palate was thread-bare. If this assertion were correct, it would be an injustice on my part to occupy your time in reading this paper. In evidence that the treatment of cleft palate is a living subject, occupying the minds and pens of the most celebrated surgeons in this special field, I present to you the statement that no less than fifty papers have been read on this topic during the last two and a half years.

An eminent oral surgeon stated not long ago that eighty-five per cent of the patients upon whom he operated had been previously operated, unsuccessfully, by other surgeons. There is no doubt of the frequency of failures. In the light of these statements, it is not possible to believe that the subject of cleft palate is thread-bare. I feel that I express the opinion of nearly all oral surgeons of large experience in performing cleft palate operations when I say that with so many failures, it is a question upon which all should be eager to receive information, from any source whatsoever.

Fifty years ago, many of the most prominent surgeons of the United States abandoned palato-plastic surgery on the ground that their operations were generally failures. While non-union occurred in a large majority of their operations, failure of function occurred nearly always. Had the surgeons of that time understood the proper age for operations, the order of procedure in the steps to be taken and the correct technic of the bone surgery essential to this work, they would have operated in infancy, with better results. From 1860 to 1880 and later, the great prosthetist, Norman W. Kingsley of



1 2 3

Figs. 1, 2, 3.—Fig. 1, A child of four weeks, exhibiting a complete cleft of hard and soft palate, with cleft lip on the left side. The nose is diverted to the right side and on a line with the right angle of the mouth. It will be observed that the nostril is very broad and flattened. This typifies the most common form of cleft palate. As usual, we find the anterior part of the cleft is very much broader than the posterior. Fig. 2, Same child, with the separated bones closed and the nose put in the median line of the face. Without any effort to correct it, the nostril has already, by reason of the closure of the palate, assumed a much better form. Fig. 3, Front view, taken the same day as Fig. 2.

Fig. 4.—Same child at the age of five months, after the lip operation was made. This child was operated in proper sequence—first, the bones; then the lip; and at the age of sixteen to twenty-two months, the soft palate will be closed. By proceeding in this way we will more nearly than by any other method, secure a condition closely approaching normality.

New York, with numerous assistants, was occupied in constructing artificial vela for cleft palate patients, many of whom had undergone unsuccessful operations. In the light of surgical advancement and the development of modern methods of procedure, the old-fashioned theory that infants could not endure palate operations and that they should be made only on children from seven to ten years of age or thereabouts, has become a thing of the past.[1] I could write at length on the declarations of eminent surgeons to the effect that the delicate tissues of infants and their frailty contra-indicated operations.

The supreme object of the surgeon in treating cleft palate is to secure anatomical normality and to establish perfect functional results. It is admitted that we cannot secure function unless we get a well-formed palate, long enough to pass backward to the post-pharyngeal wall. The soft palate must be flexible and resilient. If we would accomplish this

[1]Brophy's Oral Surgery—"Opinions of Eminent Authors," p. 609.

FIFTEEN FORMS OF CLEFT PALATE

According to the Classification of Dr. Truman W. Brophy

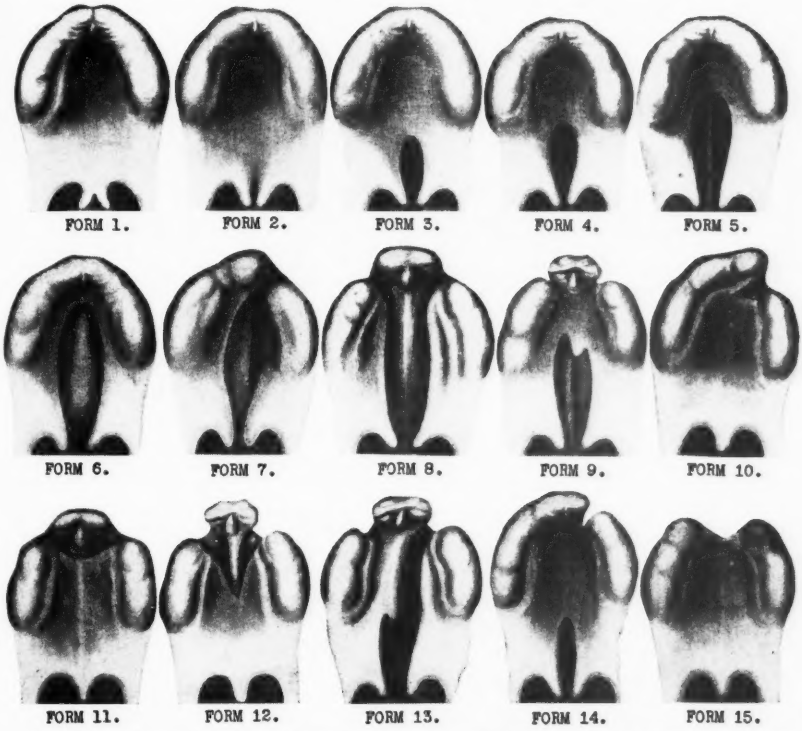


Fig. 5 a.—Forms 1 to 6 should not be operated until 16 to 22 months of age—just before speech is attempted. The bones in Forms 7 to 14 inclusive, should be operated in early infancy, preferably before the 6th month. They may be operated later, but with greater difficulty. Following the bone operation, the portion of the palate remaining unclosed assumes the condition of Form 6 and should be operated at 16 to 22 months. Form 15 is not operable, there being no tissue with which to make the arch normal. Form 16, not included in this group, is a complete separation of the premaxillae, maxillae and entire soft palate in the median line. This form is extremely rare, only one case having been reported. Treatment should be as for Form 7.

Form 1, Cleft of the azygos uvula.

Form 2, Cleft of the uvula extending forward into the fibers of the levator palati and the reflected portion of the tensor palati.

Form 3, Cleft extending through the uvula and forward to the posterior border of the horizontal plates of the palate bones.

Form 4, Cleft extending through entire soft palate, including partial or complete cleft of the horizontal plates of the palate bones.

Form 5, Cleft of the entire soft palate through the horizontal plates of the palate bones and into the palatal processes of the maxillae.

Form 6, Cleft of the soft and hard palates nearly as far forward as the line of union between the maxillae and the premaxillae.

Form 7, Complete single cleft of the entire soft and hard palates including the alveolar process. The maxilla is separated from the premaxilla, usually on the left side, and accompanied by single cleft lip.

Form 8, Tripartite cleft, extending through soft and hard palates and the alveolar processes, separating the premaxillae from the maxillae. Nearly always complicated with double cleft lip.

Form 9, Cleft of entire soft palate extending through the horizontal plates of the palate bones and, irregularly, into although not through, the palatal plates of the maxillae. The premaxillae are separated from the maxillae, between which and the posterior part of the cleft the hard palate is normal. Usually complicated with double cleft lip.

Form 10, Cleft only between the maxilla and the premaxilla, usually on the left side and accompanied by single, sometimes double, cleft lip.

Form 11, Cleft completely separating the premaxillae from the maxillae. The palate otherwise is normal. Usually accompanied by double cleft lip.

Form 12, Cleft only of the anterior one-half or one-third of the hard palate with protruding premaxillae, which are entirely separated from the maxillae. Usually complicated with double cleft lip.

Form 13, Cleft of entire soft and hard palate extending through alveolar ridge on one side, with premaxillae separated completely on one side and partially on the other.

Form 14, Cleft of the soft palate, partial or complete, normal hard palate, with cleft in the alveolar border. Single cleft lip.

Form 15, Cleft only of the alveolar process anterior to the maxillae, due to non-development or absence of the premaxillae. Usually accompanied by harelip in the median line. Inoperable.

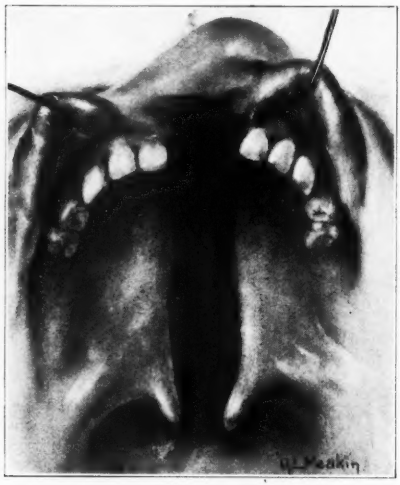


Fig. 5 b.—Form 16. An exceedingly rare form. Cleft completely separating in the median line, the entire palate and lip.

end, we must not forget that bone surgery is essential in the treatment of congenital cleft palate in young patients whenever the bones are involved (Figs. 1, 2, 3 and 4).

There is no operation more successfully performed in infants and with more gratifying results than properly moving together and uniting the separated elements of the cleft hard palate, the technic of which is described later; besides the mortality is extremely low. During the past six years, of six hundred and fifty of these operations performed in my practice, in infants under six months, the percentage was 2.77. This operation should interest all surgeons and lead them to carefully study its technic. Those who formerly opposed operating on young infants are no longer heard. Some still *do* object to normally approximating and uniting the separated bones. We know that normality cannot be secured in any other way. Some surgeons who began adjusting the bones in clefts of the palate in infancy have, by reason of failure to understand and use the proper technic, in some instances abandoned the procedure and are now following methods which do not correct the deformity nor give functional results. Every surgeon who operates on cleft palate knows or should know, that the premaxillary bones should be freshened and firmly wired to their place. I believe normality of the bones of the palate cannot be secured in any other way. If so, the methods employed have never been made known to the profession.

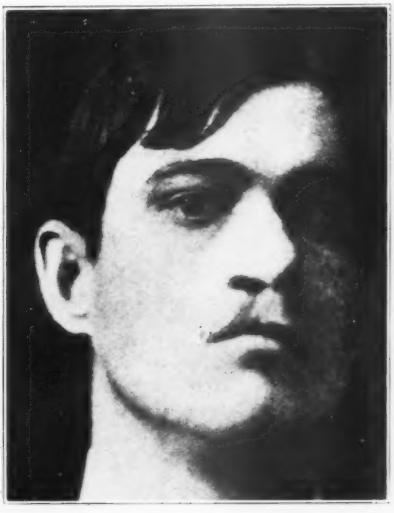
I believe the most important consideration that should present itself to the mind of the surgeon who operates upon cleft lip and palate is the *order of procedure,* from the beginning of his work until he has reached the end. We should bring the misplaced, separated bones just as nearly

as possible into normality to establish functional results. To do this, no cleft palate child should be permitted to attain an age when speech is attempted without having the necessary operations performed and the defect removed.

There are, anatomically, sixteen forms of cleft palate, all of which I have illustrated (Fig. 5 a-b). Forms one to six inclusive, do not require bone surgery, while forms seven to sixteen with the exception of form fifteen, *do* require bone surgery. The legend describing each form, according to my own classification, states to what extent the tissues are separated and names the anatomical parts involved.

In the last few years I have been more deeply impressed than in my earlier experience with reasons which have not hitherto been presented, why it is very detrimental to the patient to postpone moving the bones together and uniting them. If the separation is complete throughout the entire length of the palate, including single or double cleft lip, with protruding premaxillae, I maintain that as in displacements or abnormal positions of bones in other portions of the body the bones should *always* be operated upon first. To depend on the traction of the united lip or single wire suture to transfix the bones, leads to complications

6



7

Figs. 6 and 7.—Fig. 6, The long portion of the bone protrudes beyond the short one, as it usually does, adding to the deformity, while the arch is abnormally high. Had the edges of the cleft been freshened and correctly approximated in early infancy, a normal arch would have been produced. The condition here is not unlike an un-united fracture. The treatment should be based upon the same principles. Correct bone surgery should have been practiced early, which would have produced a normal arch, a useful palate and would have prevented this deformity.

The posterior part of the cleft has been widely separated by closing the lip and partially closing the anterior part of the cleft. The bones do not meet. If they did, they could not unite because of the intervening mucoperiosteum. Fig. 7, Same patient. A broad, flattened nostril and badly operated single cleft lip due to failure to properly assemble the bones in early infancy. The nose is deflected toward the side opposite the cleft.

which are overcome, if at all, with great difficulty (Figs. 6 and 7).

When a child has double cleft lip and protruding premaxillae, the premaxillae should be first moved into place, the surfaces which are to come in contact freshened, the compact bone removed and the freshened surfaces of the cancellated bone placed in contact and immobilized. When this is done, the soft tissues covering the bones are sutured with horsehair. To divide the vomer, move the pre-

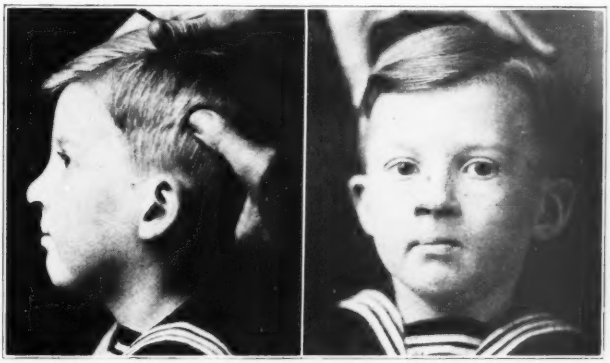
8 9 10

Figs. 8, 9, 10.—Fig. 8, Front view before operation. Fig. 9, Profile, showing extensive protrusion of premaxillae and double cleft lip. Fig. 10, Interior of mouth showing protrusion of bones, double cleft lip and cleft palate. A pulpless, loose tooth is visible. This was removed before the first operation.

11 12 13

Figs. 11, 12, 13.—Fig. 11, Premaxillae brought into correct position in relation with the maxillae, the edges freshened and perfectly immobilized. The bones are united and we have a consolidated, well-formed bony arch. As seen, the cleft of the soft palate is closed with an excellent result. Fig. 12, Front view showing double cleft lip and broadly flattened nose, the breadth being greater than the length. Operation on bones and palate completed and patient ready for lip operation. Fig. 13, Profile of boy after the premaxillae were united to the maxillae. The nose is flattened as shown in Fig. 11 and 12 due to moving the premaxillae back into normal position.

maxillae back and make no attempt to unite them to the maxillae is unsurgical, cannot produce a normal arch, and may be likened to a fracture elsewhere without immobilization and consequently without the lead plates, enables the operator to approximate the alveolar processes and at least one-third of the palatal plates of the maxillae, moving and holding the tuberosities in normal position, so that



14 15

Figs. 14, 15.—Fig. 14, Flattened nose lifted, after the lip was closed. Fig. 15, Construction of palate, lip and nose completed. It will be seen that the nose in Fig. 12 is nearly twice as broad as in Fig. 15.

union. The wires should not be passed through the premaxillae, but anterior to them and beneath the soft parts (Figs. 8 to 15).[2]

An attempt should not be made to move the premaxillae backward in a patient younger than three months, because the bones have not become sufficiently ossified to form well defined alveoli. Besides, the lateral surfaces of the teeth are not infrequently covered only by the soft parts. The teeth, in this location, obviously, at this early age may be easily displaced. The amputation of the premaxillae is an operation entirely uncalled for; it creates an irreparable deformity and cannot be too strongly condemned (Figs. 16 and 17-23).

Introducing the wire is not difficult for the well trained surgeon. Passing the wires through the bones in the usual way, anteriorly and posteriorly and adjusting

Fig. 16.—Result of amputation of premaxillae in infancy.

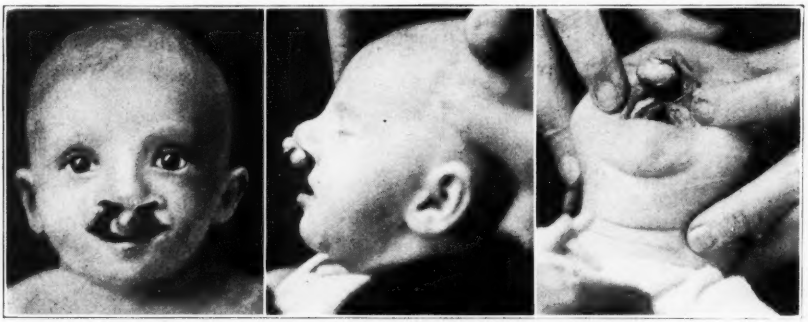
[2]Figs. 8-15, From Minnesota Medicine, May 1921.

when the soft palate is united it will be of normal length and flexibility. Criticisms have been offered by men inexperienced in using, or without the opportunity to observe the use of lead plates, that they are likely to produce necrosis of the bones. Such statements are made by men who admit they have never had experience in doing the work and whose opinions, therefore, are of no value. I have never had nor have I ever known of a case of necrosis following the *correct* use of plates in the approximation of the bones in infancy. If it has occurred, it has been due to defective technic. A patient recently returned to me after the lapse of two years, having been prevented from returning sooner by the circumstances of his parents. He had worn these plates during the two years, without the slightest inconvenience and without injury to the parts.

The double cleft lip in these cases should be closed about two months after the bone operation. If the cleft extends throughout the palate, that portion of the hard palate not united in the first operation (by reason of the high elevation of the palatal plates of the maxillae), together with the soft palate, should be closed at sixteen to twenty-two months of age—before the child begins to speak.

This plan is not always followed, however. The ancient practice of operating on the cleft lip first, is continued. The lip operation is among the oldest in the annals of surgery, described by Celsus, who was a contemporary of Tiberius (Period 42 B. C. to 37 A. D.).

An operation on the cleft lip should not be done before the important procedure of uniting the bones has been completed (See Figs. 11 and 12). It is said that closing the lip will move the broadly separated bones into contact. The closing of the lip and the resultant traction of the orbicularis oris muscle *will* gradually move the anterior part of the cleft bones into contact, but the bones *will not,* as a rule, be normally approximated nor united. The bone carrying the premaxillae protrudes beyond the maxilla of the opposite side, leaving an ugly malformation of the nose and arch. Besides, there cannot be union of the bones with the muco-periosteum intervening. They only meet, remain mal-posed and leave the patient deformed through life (Figs. 6 and 7).



17 18 19

Figs. 17, 18, 19.—Fig. 17, Congenital double cleft lip and protruding premaxillae. Maxillae and soft palate normal. Fig 18, Profile, showing protrusion of premaxillae and lip. Prolabium is seen to extend considerably beyond the end of the nose. Fig. 19, Intra-oral aspect of the protruding premaxillae. The palate was not cleft. This shows the surfaces of the premaxillae with which union was desired, by approximating the premaxillae with the maxillae.

If a wire suture is passed through the anterior part of the cleft bones, it will often cut out. It will cut out unless an incision is made over the line of union between the maxilla and premaxilla of the side opposite the cleft, the external plate of the bones separated, the protruding premaxillae crowded downward, either by bending or fracturing the lingual surfaces of the bones, so that an approximation of the cleft in the alveolar processes may be made.

20 21 22

Figs. 20, 21, 22.—Fig. 20, Three months later the premaxillae were perfectly united and solidified with the maxillae. At this time the cleft in the lip was closed. An incisor tooth is erupted from the newly united premaxillae. Fig 21, Profile of patient showing lip closed. The nose, as is usual in such cases, is drawn backward when the premaxillae are moved into correct position. Fig. 22, Profile showing deformity of the nose corrected by lifting it and at the same time narrowing the broadened nostril.

When the anterior part of the cleft is brought together, as just described, the operator fails to give consideration to the consequent separation of the bones posteriorly. Every experienced surgeon in this work realizes that oftentimes these bones are widely separated posteriorly, due to the moving together of the anterior part of the cleft and the action of the muscles, and cannot assume a normal position unless measures are employed to overcome this separation. *Unless steps are take in infancy to move the tuberosities more closely together, or at least to prevent them from more widely separating, the palate will be shortened to such an extent that perfect speech will seldom be secured.* When the tuberosities are abnormally separated, the soft palate, when united, will be put on the stretch and consequently shortened so

Fig. 23.—Front view after premaxillae, lip and nose were made normal.

that it cannot reach the post-pharyngeal wall; besides, it will be like a drumhead, without flexibility or resiliency. If lateral incisions are made through the soft palate in an attempt to relieve tension, a great mass of cicatricial tissue will follow, which makes it thick, unwieldy and inflexible. It must be remembered that lateral incisions oftentimes divide the fibers of the tensor palati muscle, which has a two-fold function—to make tension on the palate and to dilate the pharyngeal orifice of the Eustachian tube in the act of swallowing. The result of the division of this muscle leads to early deafness due to destruction of the continuity of the muscle and consequent failure of the normal dilation of the pharyngeal orifice of the Eustachian tube.

The only surgical procedure to overcome this mistake and render the palate serviceable, is to lengthen it by utilizing the palato-pharyngeal muscles. The pharyngeal muscles, by reason of the greater activity and use to which they are subjected, become broader and thicker than in a normal palate. They are seen as broad, flattened bands extending from

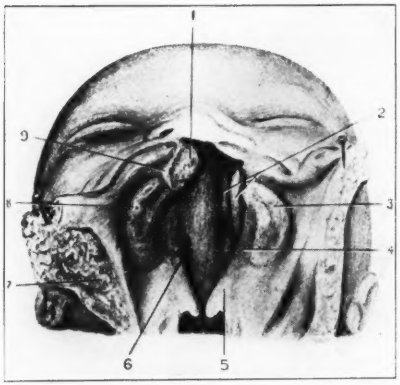


Fig. 24.—"Single left complete cleft palate with harelip. (From a specimen in the Museum of the Royal Free Hospital). 1. Premaxilla; 2. Middle and inferior turbinated bones; 3. Alveolus of the left side; 4. Hard palate; 5. Soft palate; 6. Posterior end of septum of nose; 7. Cheek turned back; 8. Alveolus of right side; 9. Frenum." Berry and Legg. In this illustration we have a very beautiful and accurate presentation of the tissues of a cleft palate infant. The deformity includes the cleft of the lip and cleft involving the entire hard and soft palate, with description. It will be observed that the separation of the bones in the anterior part of the cleft is very much wider than in the posterior part.

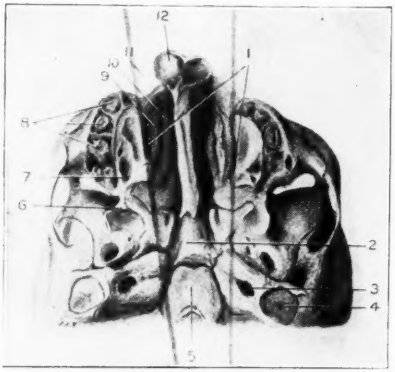


Fig. 25.—"Base of skull of a new-born infant with double complete cleft palate. 1. Edges of bony palate; 2. Basi-sphenoid; 3. Jugular foramen; 4. Membrana tympani; 5. Basi-occipital; 6. Hamular process; 7. Posterior palatine foramen; 8. Germs of milk teeth; 9. Inferior turbinated bone; 10. Middle turbinated bone; 11. Edge of bony nostril; 12. Premaxillary process with germs of central incisor teeth. Note the absence of the lateral incisors. (From a specimen kindly lent to us by Dr. Johan Ulrich of Copenhagen.)" Berry and Legg.

Again we have an excellent specimen of the bones in a double cleft of the palate. We assume that a double cleft in the lip also existed. The premaxillae protrude and the cleft is wide. The anterior part, as shown by the lines that have been placed on the figure is very much wider than the posterior part. I can see no course to pursue in the treatment of cases like this except to assemble the ununited bones and bring about union. (See Figs. 8-15.)

(Note: Mr. James B. Perry of London kindly permitted me to make use of Figs. 24 and 25. The legends which appeared in Berry & Legg's book on Cleft Palate have been photographed and made a part of the illustrations).

the palate downward and outward to be inserted in the posterior part of the thyroid cartilage. By utilizing two-thirds of each muscle and adding it to the end of the palate, we are able to secure as long a palate as we wish. The function of the muscles of the pharynx is not impaired, while the palate is lengthened sufficiently to enable it to come in contact with the posterior pharyngeal wall.

The anterior part of the cleft, at birth, in complete cleft of the bones, is nearly always wider than the posterior part. This statement, I realize, is not in accord with statements sometimes made by others, but upon examination of hundreds of these patients, I am satisfied that the *anterior part of the cleft is nearly always broader at birth than is the posterior part.* (Figs. 24 and 25.) The operation of uniting the lip first, narrowing the anterior part of the cleft and more widely separating the posterior part, making the soft palate when it is united so short that it cannot reach the post-pharyngeal wall, is one of the most serious errors in palatal surgery. Such a procedure places the greatest obstacle in the way of distinct articulation.

It is easily understood, when carefully considered, that as the separated anterior alveolar processes move *toward* each other, the tuberosities of the maxillae move *from* each other, by reason of the fact that the malar processes serve as pivots upon which the bones move. The action of the bones is precisely like that

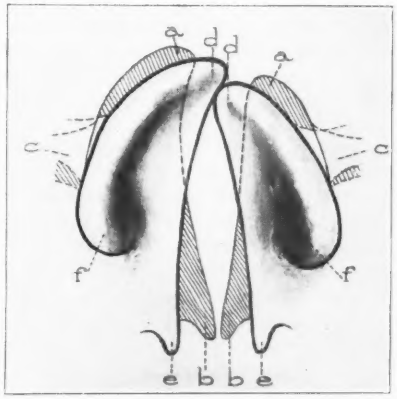


Fig. 26.—Drawing showing change in position of the palate and alveolar processes due either to contraction of the orbicularis oris muscle after the lip operation or the result of moving the anterior alveolar processes together. a—a, Bones widely separated at birth; b—b, Posterior part of cleft at birth; d—d, Anterior part of cleft after bones are moved together but not united; e—e, Posterior part has separated widely. As the anterior part moves together the posterior part separates. f—f, The tuberosites widely separated as the result of failure to move them together, or to prevent them from separating; c—c, The malar processes, the pivots upon which the leverage is exerted to move the posterior parts outward while the anterior parts are moved inward.

27a 27b 28

Figs. 27a, 27b, 28.—Fig. 27a, Cast showing the premaxillae removed with extremely broad cleft of the palate. The distance between the buccal surfaces of the third molars measures 3¾ inches. Fig. 27b, Lower arch equally broad. **Fig 28, Good occlusion of the teeth.**

of a lever with the fulcrum near the middle—when one end is moved inward, the opposite end moves outward (Fig. 26.).

Anyone who will examine the mouth of a patient for whom the lip has been first closed can see at a glance that the approximation of the anterior part of the cleft by traction of the lip, or by the use of a single wire suture to transfix the bones, greatly broadens the cleft in its posterior part. The breadth of the separation is greater than that which existed in the anterior part at birth. (Compare e—e with a—a, Fig. 26.)

While in London in September, 1921, I was invited to visit Guy's Hospital so that, as I was informed, I might be shown

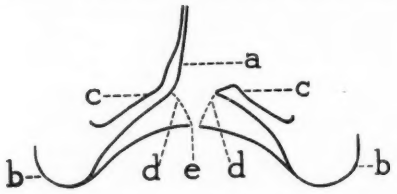


Fig. 29.—Illustration showing the position of the horizontal plates of the maxillae and the vomer as they usually appear in single cleft lip and cleft palate. We find the horizontal plates very greatly elevated and there is almost invariably enough tissue to close the palate. b—b, alveolar processes; c—c, horizontal plates; a, vomer; e, separation of the hard palate as it would be if the horizontal plates were lowered; d—d, lines of descending arch.

in practical cases that normal occlusion of the teeth and a normal breadth of the arch always occurs in cleft palate patients for whom operations have not been made. I visited the hospital, examined a number of the patients—as I remember, nine. In every case, with the exception of one, the posterior teeth were not in normal position, neither upper nor lower, yet in most cases the teeth occluded well. The arches in the posterior part were all abnormally separated, as there was no resistance against separation, while the lower teeth, by reason of the occlusion, followed the upper teeth with the spreading of the arch. Figures 27 and 28 show construction of arch and teeth similar to those exhibited. It is a habit of Nature to adjust the normal parts to abnormalities which exist. Successful early operations in these cases would have prevented this deformity.

In the newborn we find these parts not only separated, but the plates forming the hard palate are often elevated by the pressure of the tongue and mandible to an angle of 45°, and in extreme cases to 72°, and that pressure naturally moves the separated edges farther apart than in the vault of normal height (Fig. 29). There is no better way of illustrating the condition of the palate shown in Fig. 29

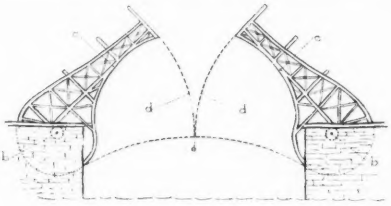


Fig. 30.—Following the same lettering as far as possible, for we have no (a) representing the vomer, b—b, are the pinions of the bridge which corresponds to b—b, the alveolar processes above; c—c, correspond to the horizontal plates of the palate bones, misplaced upwards; d—d, lines of the descending arch which terminate in the meeting of the hemispheres of the bridge at (e); f, line of new arch.

than in the drawing of the bascule bridge. Whoever holds the opinion that there is an absence of tissue in Figure 29 might with equal propriety say the engineer failed to put sufficient material in this bascule bridge to complete it. Once understood, the force of the illustration will be appreciated (Fig. 30).

The action of the pressure of the tongue against the palatal plates from early embryonal life may be recognized after birth by the most casual observer. In an infant with cleft palate the tongue is almost constantly in the fissure, extending up into the nasal cavity (Fig. 31).

Having performed over five thousand cleft palate operations, eighteen hundred forty-four of which were upon infants under six months. I have found that the upper jaw, in comparison with the lower is much broader than it should be. The palatal plates of the maxillary and palate bones are not only separated, but, as stated, they are abnormally elevated. *When we move the borders of the alveolar processes and one-third of the cleft palatal plates into contact, we have brought the upper jaw to its normal breadth and into its proper relation to the lower jaw.* There are very few exceptions to this statement.

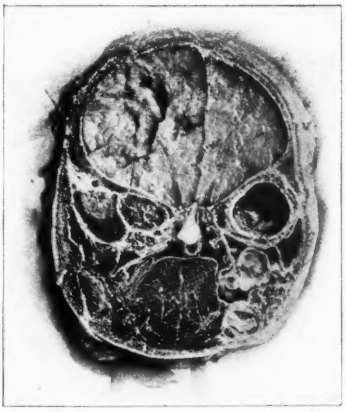


Fig. 31.—Longitudinal section of infant cadaver's head showing palatal plates highly elevated by pressure of the tongue. The angle is about 45°. The palatal plate of the left side is directed upward and outward, the upper part not being in contact with the tongue but curled underneath the inferior turbinate bone.

(Note: J. S. Stone, Boston Medical & Surgical Journal, Nov. 14, 1901.)

I am convinced that an accurate measurement of the palatal surfaces of the separated bones will show that the distance between the borders of the cleft and the center of the alveolar processes presents as broad a surface as will be found in the bones of a child of the same size whose palate is normal. Further, to repeat what I have stated previously: When, by reason of the pressure of the tongue and mandible against the alveolar inclined planes, the separated bony plates are carried upward to an extreme height and laterally, the separation naturally is greater, as illustrated, than it would be if these plates were not thus elevated, and misplaced. I am aware that occasionally we find an absence of nearly all of the hard palate. This is not the result of atrophy, but of failure of development of the bones. These cases, however, are extremely rare.

Summary

See that the child is in good physical condition and gaining weight. A competent pediatrician should prepare the child for operation and care for it until it is discharged. A study of the thymus gland is of great importance. We know that status thymico-lymphaticus is a serious menace to surgical procedure in young children. A routine measure should be adopted of making a roentgenogram of the chest to determine whether the thymus is of normal size. Percussion will fairly well outline the borders of the gland, but the x-ray is conclusive. If the gland is enlarged, operation should be deferred. Often one treatment of x-ray will be sufficient to reduce the gland to normal size, after which the operation may be made,—usually within six weeks.

The order of procedure in operating is as follows:

1. When the cleft of the palate is complete, the first stage should be the approximation and union of the bones, preferably before the third month. It may be done later, but with increasing difficulty. Beyond the age of one year, the bones are moved together gradually by tightening the wires from time to time.

2. Six to ten weeks after the bones are united, the operation upon the cleft lip is made.

3. When the child is from sixteen to twenty-two months old, the soft palate is closed. In any event this should be done, if possible, before the child begins to speak.

The careful consideration and observance of the statements made above will give as a result, a long, well-formed palate and arch upon which to construct a full, well-shaped lip and normal nose.

It is obvious that there should be some progress in palato-labial surgery since the days of Celsus who, ninteen hundred years ago, operated to close the lip, while the palate was not considered. It is also obvious that, while the closure of the lip *will* move the bones together in the anterior part of the cleft, they are still un-united, usually malposed and the deformity of the bones, lip and nose remains. A single wire suture through the anterior part of the cleft may make union of the alveolar processes, after freshening, possible, but neither of these procedures will enable the surgeon in the final operation to secure a functioning soft palate, by reason of the spreading of the arch.

Conclusions

1. The greatest obstacle in the way of success in maxillo-palatal surgery is a lack of knowledge of the methods of procedure.

2. So long as the majority of medical colleges utterly fail to teach their students this subject, just so long the principles underlying the surgery of the palate will not be understood and, as in the past, there will continue to be innumerable failures in operations.

3. Those who operate on cleft palate only occasionally and the uninformed do not realize that maxillo-labio-palatal surgery is a vast field for study and practice.

4. When we see mutilations, such as amputation of the premaxillae, et cetera, which cannot be too strongly condemned; when we see that many without a knowledge of the fundamentals of the subject are continuing these practices, we feel that all measures available should be employed to stimulate the study of oral surgery and thus avert such calamities.

5. To practice this department of surgery, a young man should have earned in course both dental and medical degrees and have at least one year's post graduate work with a busy oral surgeon.

6. There are no operations in the whole broad field of surgery in which the general surgeon has so large a percentage of failures as in palatal surgery.

7. It must be remembered that the most careful operator, who has performed a perfect operation, may fail to secure a good result because of specific disease. Moreover, sometimes a most promising case, coupled with the greatest care and perfect technic, may result in failure on account of conditions beyond the surgeon's control. And further, it must be remembered that every surgical operation, even of the most minor nature, has in it an element of uncertainty and danger to life. Maxillo-labio-palatal surgery is not an exception to this statement.

8. My observation has been that function often has not been considered as an object to be attained. It seems that operators too frequently aim to close the cleft without achieving the all-important anatomical functional results.

9. As I have said, function is dependent more on preventing the tuberosities from spreading than any other factor. When they *are* spread they must be, in young infants, narrowed to their normal breadth.

10. The surgeon who permits the tuberosities of the maxillae to spread, thus making it impossible to secure a long palate, will meet with failure in his results and, usually, correct speech will be impossible. In such cases, to make a palate that will reach the postpharyngeal wall, a section of each of the palatopharyngeal muscles may be added to it.

11. When the bones are separated at birth, there is only one logical course to pursue: That is, to freshen the surfaces that should be united, as would be done with an un-united fracture, and approximate and immobilize them. All general surgeons *do* so treat fractured bones, but all oral surgeons *do not* always do so.

12. I insist that the surfaces of the protruding premaxillae be freshened as described in this paper, the freshened, cancellated bone of the premaxillae approximated with the freshened, cancellated bone of the maxillae, and immobilized. *I care not what method is employed, but I insist that it shall be done.*

13. Moving the bones together in the anterior part of the cleft without attempting to prevent the tuberosities, which are oftentimes already abnormally separated, from further spreading contributes to the making of a short palate, followed by defective speech.

14. Spreading of the tuberosities makes the palate too short, and a palate too short makes the function of speech defective.

15. A long flexible, resilient soft palate, correctly functioning, is largely dependent upon a normal bony arch.

16. To fail to unite the bones in early infancy generally leaves a deformity throughout life.

17. To operate on the soft palate of a child under 16 months of age is to invite failure.

18. The surgeon, after operating on a soft palate in a youth or adult, finds the united palate tense and short. He states it is due to atrophy prior to operation. It may be due to atrophy in part, but in a large majority of such cases, spreading of the bones is an important factor in making the palate short, tense and drum-head-like.

19. Failure of union of the soft parts is often due to failure to properly denude the bones of the muco-periosteum and to improper suturing.

20. Tension of the palate is to a great extent relieved by lowering it as far laterally as the hamular process instead of making incisions in muscular tissue.

21. The mattress suture is often valuable in the muscular tissues but the interrupted suture is more desirable in the muco-periosteum with an occasional mattress (end to end) suture.

22. An operator sometimes fails by making his sutures too tight. He must bear in mind that the tissues will not stand pressure and stretching; there must be relaxation sufficient to insure good circulation.

23. An incision of the tissues covering the hard palate close to the teeth—a Langenbach—is sometimes necessary when the tissues do not approximate easily.

24. Packing the incisions with iodoform gauze saturated with compound tincture of benzoin is usually desirable, leaving the packing in for 48 hours, then removing it and adjusting fresh packing.

25. Failure of union of the soft parts is sometimes due to the cutting out of sutures. The proper use of silver wires and lead plates will avoid this.

26. The lead plates are not intended to be used for stretching the palate and pulling the edges together, but are to be used when the wires are inserted and the palate sutured—then the plates are put gently in contact with the mucous membrane and the wires twisted, but not too tight. The plates are to prevent the sutures from cutting out and to hold the edges of the cleft steadily together; besides, the plates act as splints so when the palate moves, it moves *en masse*. Extending over a period of 40 years, we have read from time to time of devices—plates, et cetera—used to prevent the tongue from interfering with the newly

approximated surfaces of the palate. Their use, however, has been transient. The wires with which the lead plates are fixed are bent down in such a way that they do not lacerate the tongue, but contact of the tongue with them is not comfortable. It, therefore, is kept away and the palate is not disturbed.

27. It is the duty of the surgeon to see that the plates are properly adjusted. If they are not properly adjusted, if they are made too tight, if they are so adjusted that they will cut the tissues, failure is likely to follow.

28. The palate needs thorough cleanliness. With daily observation on the part of the surgeon and cleanliness of the field of operation on the part of the nurse, the highest degree of success in treating cleft palate may be achieved.

It must appeal to every surgeon, who logically looks upon the situation, that articles which have appeared in certain text books in the United States, England, France, Spain and some other countries, repeating the writing of authors hundreds of years ago on the treatment of cleft palate, are antiquated and do not set forth the truths that have been revealed up to this period. The author of a text book assumes a great and solemn responsibility. *"By their fruits ye shall know them."* Every child who is operated on by a surgeon whose knowledge in treating these cases was acquired by *reading* a text book with such teachings as the excision of the premaxillae and consequent permanent mutilation of the patient, may well place the responsibility of this procedure at the door of the man who taught it.

I sincerely trust that my opinions and assertions on the surgery of the palate will not be misunderstood nor misconstrued. Let me express my only motive in writing this paper. My thoughts first take the form of a hope. My hope is that authors of text books may no longer teach theories that have been dissipated by the lapse of time; that they will, instead of advocating biased and ancient theories from men inexperienced in modern methods, accept and teach, wherever they may be applied, the laws governing modern surgery of the bones. *Furthermore, my motive is to stay the hand of the surgeon who would excise the premaxillae and mutilate and deform his patient for life; and lastly, I appeal to the surgeon to assemble the un-united malposed bones and, as nearly as possible, to establish normality.*

PHYSIOLOGICAL AND PATHOLOGICAL VARIATIONS IN THE COMPOSITION OF HUMAN SALIVA[1]

By HENRY C. FERRIS, D.D.S., and E. E. SMITH, Ph.D., M.D., With the Collaboration of E. V. GRAVES

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PART I. INTRODUCTION

THE generally recognized functions of human saliva are its digestive actions, whereby food starches are split into dextrins and sugars; its action in moistening food, thereby rendering such food suitable for the manipulations essential to mastication; its solvent action, whereby dry and solid food may be brought to exert the stimulating action of such food on the taste nerves; and, finally, its lubricating action that renders smooth the passage of the food bolus along the esophageal canal. In addition to these functions, which have to do with saliva in relation to food, is the moistening or lubricating action of saliva upon the mouth to render possible the movements of tongue and cheeks, especially necessary for speech. Hence, its secretion is essential apart from food ingestion.

The conditions of the salivary secretion that render it suitable for these various functions are, in part at least:

(1) The production of an adequate quantity of secretion. This is important both during and apart from food ingestion. The quantity is determined by the demands made by food ingestion; psychic influences, associated with food ingestion, under which heading may be included the influence of odors, sight or the thought of food; mental states independent of food suggestion, such as the influence of fear in inhibiting salivary secretion; and, finally, mechanical stimulation, either from the action of foreign inert substances in the mouth or even from the movements of the tongue and cheeks when the mouth is empty.

(2) The production of a medium suitable for the conduct of the salivary digestive processes when the saliva is mixed with the food. The essential elements, aside from the moisture, to establish this are the presence of sufficient digestive ferment or enzyme, the ptyalin, and any other enzymes; the existence of a chemical reaction or hydrogen ion concentration that will establish the optimum reaction for enzymic activity; and the presence of saline matter, so that electrolytes accelerating enzymic activity shall be present.

(3) The presence of suitable lubricating material. Aside from the moisture, this is largely supplied by the mucin.

Besides these essential ingredients of the saliva are certain other constituents, mostly in minute amounts. With our limited knowledge of the physiology of this secretion, and especially with the ever increasing physiological knowledge that substances heretofore not suspected of any important part in the body processes do in fact play a most important function, such as the action of the

[1]Report of studies conducted under a grant by the Scientific Foundation and Research Commission of the American Dental Association.

endocrine secretions and especially of the hormones, it is hazardous to claim that such other salivary ingredients are only incidental or even excretory products. We can only say that they are not known or have not been demonstrated to be of functional value.

Saliva as it occurs in the mouth is the product of secretion of at least four sets of glands, the parotid, submaxillary, sublingual and the many buccal glands. Moreover, the character of the secretion of the individual glands is quite different. On the one hand, the parotid secretion is particularly rich in ptyalin but without mucin; while on the other, the submaxillary, and especially the sublingual, low in ptyalin, are rich in mucin as well as in those salivary constituents that give alkalinity to the secretion. Further, even the same gland varies at different times in the character of its secretion, being under the control of at least two physiological varieties of nerve stimulation, the secretary, which controls the secretion of water and of inorganic salts; and the trophic, which controls both the formation in the gland cells and the secretion as well of the organic products of the cell metabolism—the ptyalin in the case of the parotid and mucin in the case of the submaxillary and sublingual—which products more especially characterize the physiological activity of the secretion of the particular gland.

It will appear, then, that saliva as it is found in the mouth is an admixture not only of the secretions of a variety of glands, which secretions take on the characteristics of the particular glands of origin, but also an admixture of the secretions of a group of glands the character of which secretion may vary in the case of each individual gland according as its dominating stimulus is secretory on the one hand or trophic on the other, and hence which secretion varies even though it originate from the same gland. These facts render most complex the interpretation of variations in salivary composition.

Considering the variety of functions of saliva, as already suggested, we may briefly describe these as:

(1) Moistening and dissolving the food, which function is served by the volume of saliva, as determined by the secretion of all the major salivary glands, and probably particularly the parotids, under the secretory stimulus of these glands.

(2) The digestion of the carbohydrate food, a function served by the secretion, as regards ptyalin production, more particularly of the parotid glands under trophic stimulation, and possibly of the submaxillary and sublingual glands, as contributing to the establishment of an optimum reaction of the food mixture, all of the glands probably secreting salines whereby electrolytes, stimulating enzymic activity, are supplied.

(3) The lubricating of the food bolus, which function, aside from the moisture already considered, is the result of mucin production in which the parotids do not participate but which is to be credited largely to the submaxillary and sublingual glands under trophic stimulation and to which the buccal glands may contribute to a minor degree.

(4) The moistening and lubrication of the mouth in the absence of food, which is probably largely the function of the buccal glands during absolute rest but which is markedly supplemented, as demanded, by submaxillary and sublingual secretion, probably under secretory stimulation, during movements of the mouth, this being marked during speech.

It thus appears reasonable to suppose that normally during entire rest the saliva as it occurs in the mouth is made up chiefly of the buccal secretion with a minimum of sublingual and submaxillary secretion produced under secretory stimulation; that during mechanical

stimulation in the mouth there is added more sublingual and submaxillary secretion under secretory stimulation, with some secretions from the same glands produced under trophic stimulation and possibly a minimum secretion from the parotid glands, produced largely, if not entirely under secretory stimulation; and that when food is present in the mouth, and particularly during mastication, there is added both an increase from all the glands of saliva produced under secretory stimulation and a large outpouring of saliva produced under trophic stimulation, the quantity and nature of which possibly may vary with the character of the food undergoing mastication. In making any studies of salivary composition, and particularly in their interpretation, it is important to have in mind all of the possibilities which we have just outlined.

In the studies of saliva which we herewith present, it has been our aim to determine the composition of the saliva in the absence of food stimulation both in its physiological variations and in a wide range of pathological conditions both oral and systemic, and to compare these findings with the composition of the corresponding blood, urine and feces. Of necessity, such a pretentious task can hardly be more than approached in the confines of a single series of observations, however energetic and well directed the research may be. However, even an approach to the problem can hardly be without some additions to our knowledge of the subject and, we hope, the obtaining of new points of view sufficiently fundamental to be the basis upon which work continued along the same lines in the future may be constructed.

In instituting such an important extension of the study of salivary composition, it has seemed important to review somewhat critically the technic to be employed, including the analytical methods, and to take advantage of recently developed methods not formerly available. This we have done, even to the extent of adapting to salivary analysis methods not previously used for this secretion.

At the outset of the work, it has been deemed desirable to consider the composition of saliva with special reference to its function. Heretofore, records of salivary composition have chiefly shown the ingredients as proportional constituents. According to our present views, the important question to be considered is what the salivary function is in a given time; and not only is this true of the quantity of saliva as a whole, but of each individual activity or constituent. With the recognition of this and an appreciation of what may be termed the physiological normals, in distinction from the chemical normals, it is believed the question of pathological variations will be more comprehensively indicated.

The fullest knowledge of salivary physiology and pathology would be yielded by the composition of the secretion in 24 hours. Obviously it is impractical to obtain this information, and for the present we must content ourselves with what is revealed by the saliva collected during some particular period of the 24 hours. Moreover, owing to the necessity of isolation to avoid psychic influences, the advantage of collection while in a condition of metabolic rest and the need to meet the convenience of the patient in the application of the procedure to private practice, so far as it may be done without serious sacrifice, the collection should be made at a time of the day farthest removed from food ingestion and when the patient may report at the office. For these reasons, 11 A. M., the hour preferred in previous work (Ferris), has seemed to us a suitable standard hour for collection. The patient collects the saliva until 40 cc. or more have been obtained, the time consumed being accurately noted. At the present stage of our work we are inclined, as a matter of convenience, to adopt 20 minutes as the unit of time. Accordingly, the volume for this period

is calculated, as is also the amount or activity of each constituent part.

The analysis of the specimen must be made practically immediately after the collection as regards certain constituents, within a few hours as regards others, while certain determinations may be quickly brought into a condition where the major part of the work may be deferred, if necessary, almost indefinitely.

The following list gives in outline the several determinations made on the 40 cc. specimen collected:

	No. cc. used
Whole saliva	
Specific Gravity	
Total solids, organic matter and ash	2
Supernatant saliva, after centrifugalization	
CO_2	1
Acidity	2
Alkalinity	2
pH	1
Ptyalin	2
Solids, organic matter and ash	2
Thiocyanates	2
Chlorides	2
Total Nitrogen	2
Urea Nitrogen	2
Ammonium Nitrogen	2
Demucinized Nitrogen	2
Non-protein Nitrogen	2
Sodium	4
Potassium	0.2
Calcium	4

The methods employed are presented in detail in the description of technic at the end of the paper. Emphasis may be given at this point to a few of the important features.

Carbon dioxide has been determined by the gasometric method of Henderson and Morriss (1) in the centrifugalized supernatant saliva, in which the small amount of free CO_2 in solution incidental to the contact or admixture of the saliva in the mouth with the expired air is probably largely removed.

Hydrogen ion concentration is determined by comparison, using a LaMotte comparator set. It will be noted that we disregard the influence on the pH of the acidic sediment.

Ptyalin is determined under standard conditions by measuring its activity in 5 cc. solution containing 20 mgs. standard potato starch, standard buffer solution of hydrogen ion concentration 6.7 and electrolytes from the presence of 0.05% sodium chloride. The unit of ptyalin is arbitrarily taken as fifty times the amount that will suffice to cause the entire disappearance in 30 minutes of iodin color-producing substance in such a solution, maintained at exactly 40°C. It is the amount of ptyalin that thus acts upon 1 gram of starch. We have given particular attention to the working out of this procedure, as there seemed to be no method available that embodied the essential qualities to measure adequately this activity (2).

Chlorides have been determined by removal of protein by saturation with picric acid and titration by the Volhard method as modified by Harvey and adapted to blood chlorides by Myers (3).

The nitrogen of the various constituents noted containing this element has been determined by adaptations of the micro-chemical methods now widely used in blood analysis.

Sodium has been determined gravimetrically as pyroantimoniate; potassium volumetrically by titration of the cobaltinitrite with standard potassium permanganate; and calcium by titration of the oxalate with permanganate; the methods being an adaptation of those described by Kramer and Tisdall (4) for these bases in blood.

Part II. The Composition of Saliva

The variations to which the salivary flow and composition are subject under widely different dietary conditions are indicated by observations on three subjects. E, H and I, selected without regard to any dental or medical pathology. They partook of the indicated diet without restriction as to amounts for three consecutive days, the saliva being collected, in general observing the technic outlined, on the morning immediately following. There were four such

periods of specialized dietary condition: (a). Diet exclusively animal food. (b). Diet exclusively vegetable food (milk, eggs, butter not allowed). (c). Low salt mixed diet, in which not only was salt excluded at the table but to a certain measure in the cooking, and all food commonly containing salt in quantity was avoided. (d). High salt mixed diet, in which 10 gms. pure sodium chloride were taken daily in addition to the salt contained in the ordinary diet. On the same morning that the salivary collections were made, the urine was collected, covering the renal secretion over a period of exactly 3 hours (8 to 11 A. M.). In order to facilitate comparison with the saliva the urinary composition was expressed both as per cent (grams per 100 cc.) and as grams per 20 minutes secretion.

The indications of the observations as to the volume of the saliva are:

(1) The nature of the diet, as to animal, vegetable or low salt mixed, had little influence on the subsequent resting salivary flow, the 20 minute volume varying from 8.2 to 16.8 cc., average 12.0 cc.

(2) The high salt mixed diet was accompanied by an increased subsequent resting salivary flow in the two observations, with 20 minute volumes 15 cc. and 17.6 cc., average 16.3 cc. Some consideration must here be given to the fact that the absolute quantity collected by I was only 24 cc., but even allowing for this, the greater flow seems to be clearly indicated.

In interpreting the rate of flow it is important to take into consideration the total volume collected, since without doubt as a rule the rate of flow is greater during the early and less during the later part of the collection time. Thus, in the collection Hd above, 20 cc. were obtained during the first 20 minutes of collection and 24 cc. during the sub-

TABLE 1

VOLUME

	URINE	SALIVA		
SUBJECT	*20 minutes volume cc.*	*Collection time minutes*	*Volume cc.*	*20 minutes volume cc.*
a. Exclusive animal diet.				
E	7.8	82	46	11.2
H	13.3	60	42	14.0
(average)	10.5			12.6
b. Exclusive vegetable diet.				
E	7.2	65	43	13.2
H	6.7	90	45	10.0
I	6.4	64	40	12.5
(average)	6.8			11.9
c. Low salt mixed diet.				
E	6.6	84	41	9.8
H	13.3	50	42	16.8
I	11.3	88	36	8.2
(average)	10.4			11.6
d. High salt mixed diet.				
H	14.0	50	44	17.6
I	10.1	32	24	15.0
(average)	12.1			16.3

sequent 30 minutes. This also will explain why the rate of flow given in the present presentation is less than previously reported (Ferris), namely, because of the greater amount of the specimen collected, extending over a longer period of time.

It is interesting to note that the salivary flow does not vary, certainly not to any marked extent, with the urinary flow, though with subjects E and H the urinary flow were factors in the changed relation noted in the Ic specimen. Such an explanation is in accord with the conditions that existed, namely, that subject I was not able to isolate himself for the collections of saliva and so was doubtless under some variable psychic influence at the time of the collection.

The distinctive features of the sediments are:

(1) The variations in amounts, direction of the salivary variation in the different periods is the same as that of the variation of urinary flow, though the change is less in degree. With subject I, however, there is a reverse of this relation, the salivary flow of period c being only two-thirds that of b, yet with the urinary flow nearly double. This seems to indicate conclusively the absence of parallelism of the salivary and urinary flows, a conclusion that is quite in accord with general observations. Thus, it is commonly recognized that apprehension and fear tend to inhibit salivary flow and increase urinary flow. Hence, the significance, if any, of the inverse variation noted, namely, that psychic inhibition of salivary and stimulation of total, organic and ash, are not a factor of the preceding diets.

(2) The variations in amounts are in general characteristic of the individual, that of H being highest, E intermediate and I lowest.

It may be noted here that in the collection of specimens the sediments appeared in greatest amounts in the early part of the collection periods and were relatively slight in the latter part. Moreover, they are seen under the microscope to consist practically wholly of epithelia of the oral mucous membranes. It is apparent, therefore, that the sediment is merely incidental to the presence of the saliva in the mouth. On this account, the routine established has been to re-

TABLE 2

SEDIMENT

SALIVA

	100 cc.			*20 minutes*		
SUBJECT	*Organic gms.*	*Ash gms.*	*Total gms.*	*Organic gms.*	*Ash gms.*	*Total gms.*
a. Exclusive animal diet.						
E	.135	.015	.150	.0151	.0017	.0168
H	.110	.115	.225	.0154	.0161	.0315
b. Exclusive vegetable diet.						
E	.100	.035	.135	.0132	.0046	.0178
H	.200	.075	.275	.0200	.0075	.0275
I	.150	.000	.150	.0188	.0000	.0188
c. Low salt mixed diet.						
E	.175	.050	.225	.0172	.0048	.0220
H	.250	.050	.300	.0420	.0084	.0504
I	.110	.015	.125	.0090	.0012	.0103
d. High salt mixed diet.						
H	.265	.050	.315	.0466	.0088	.0554
I	.....	.....	.....	.....	.....	.....

move the sediment by centrifugalization and use the clear supernatant saliva for the determination of the salivary composition.

The figures of the table show that the salivary solids vary from 0.275% to 0.375%, average 0.334%, in the specialized dietary periods under consideration; and in the 20 minute secretion

TABLE 3

SOLIDS

	grams per 100 cc.				*grams per 20 minutes*			
	URINE			SALIVA	URINE			SALIVA
SUBJECT	*Total*	*Organic*	*Ash*	*Total*	*Total*	*Organic*	*Ash*	*Total*
a. Exclusive animal diet.								
E	8.06	.140	.225	.365	.629	.0157	.0252	.0409
H	6.50	.125	.225	.350	.865	.0175	.0315	.0490
(average)	7.28	.133	.225	.358	.747	.0166	.0283	.0450
b. Exclusive vegetable diet.								
E	7.54	.125	.225	.350	.545	.0165	.0297	.0462
H	6.76	.150	.225	.375	.451	.0150	.0225	.0375
I	4.42	.....	.....	.275	.280	.....	.....	.0344
(average)	6.24	.137	.225	.333	.425	.0158	.0261	.0394
c. Low salt mixed diet.								
E	7.80	.075	.225	.300	.515	.0074	.0220	.0294
H	4.42	.075	.225	.300	.588	.0126	.0378	.0504
I	3.77	.125	.225	.350	.426	.0103	.0185	.0288
(average)	5.33	.092	.225	.317	.510	.0101	.0261	.0362
d. High salt mixed diet.								
H	6.50	.085	.240	.325	.910	.0149	.0422	.0571
I	6.24	.100	.250	.350	.630	.0150	.0375	.0525
(average)	6.37	.092	.245	.337	.770	.0150	.0399	.0548

again rising both relatively and absolutely on the high salt mixed diet. Since there was no effort at the establishment of a metabolic balance, it is of course recognized that these changes may be merely quantitative and not necessarily a qualitative function of specific diets. Our aim in considering the solids, however, is to note the comparative changes in urinary and salivary composition during a variety of dietary conditions, and it is of no immediate moment whether the changes are qualitative or merely quantitative. Other phases of salivary composition may throw light on the qualitative differentiation.

from 0.0288 gram to 0.0571 gram, average 0.0426 gram. Omitting the high salt dietary, the percentage variation is the same; while the 20 minute elimination averages 0.0396 gram instead of 0.0426 gram. The indications from the findings, including as well the urinary solids, are:

(1) With change in the character of the diet there is a distinct change in the urinary solids, both in relative and absolute amounts, being on the average high with animal food, low with vegetable food, relatively lower but absolutely higher on the low salt mixed diet and

(2) The changes in salivary solids are in general paralleled with those in urinary solids, excepting that in the case of the saliva the changes are very much less marked. In individual instances, however, this parallelism does not hold. Compare, for example, the salivary figures for Ea (animal diet), 0.365%—

0.0409, 20 minutes, and Eb (vegetable diet), 0.350% — 0.0462, 20 minutes. Here the reduction of urinary solids, both relative and absolute, is accompanied by a slight relative reduction of salivary solids, but a distinct though not large absolute increase of salivary solids, corresponding to some slight increase of salivary flow. Moreover, it will be noted that this increase, though largely in the ash of the salivary solids, is participated in to some slight degree by the organic matter.

The conclusion is indicated that while dietary variations may cause considerable variation in the percentage and absolute urinary solids, as a rule they cause only slight variation in the percentage of the salivary solids, the saliva tending to maintain a constant per centage composition; and that the influence on the saliva shows itself to a greater degree in the salivary solids for a unit of time. This was particularly marked with high salt elimination, which increased the 20 minute salivary solids to an average of 0.0548 gram, though the percentage composition averaged 0.337%, the average figure of the other special dietary periods.

From the data on hand, considering the relative amounts of ash and organic matter of which the solids are made up, it is found that in the first three periods the percentage ash is constant, 0.225%, while the 20 minute ash varies from 0.0185 to 0.0378, average 0.0267 gram; and the percentage of organic solids varies from 0.075% to 0.150%, average 0.117%, while the 20 minute quantity varies from 0.0074 to 0.0175, average 0.0136 gram. It thus appears that variations in percentage composition are brought about solely by variation in the quantity of organic solids; while in the 20 minute periods the ash varies with the volume and the organic solids vary independently of the volume, being markedly less on a low salt diet. This would seem to suggest that salt of the diet plays a rôle in augmenting the secretion of the organic solids of the saliva.

Looking now to the relative organic and ash solids after the high salt mixed diet, it appears that the percentage ash is increased from 0.225% to 0.245%, and the organic solids remain 0.092%. In the 20 minute secretion the ash rises to 0.0399 gram and the organic solids rise to 0.0150 gram.

The findings as to chloride elimination of the resting salivary and the corresponding urinary flow are:

(1) The urinary flow varied as to the percentage and 20 minute elimination corresponding to the character of the diet, excepting that while the subjects all reached a condition of lower relative chloride elimination in the three days of low salt mixed diet, the 20 minute elimination was notably low only with subject I. However, on the average it was the lowest chloride eliminating period, while vegetable, animal and high salt periods showed average amounts increasing in the order named.

(2) The saliva showed its lowest percentage chloride elimination in the animal diet period, while in the vegetable period, the low salt mixed diet and the high salt mixed diet periods it is strikingly constant, triple the urinary percentage in the high as compared with the low salt mixed diet periods with H and I being accompanied by salivary percentage rise of only about one-sixth That is to say, the urinary percentage elimination of chlorides was affected ten times as much by the high as compared with the low chloride ingestion as was the salivary percentage elimination.

The 20 minute salivary chloride elimination was little different excepting in the high salt mixed diet period, where it was strikingly increased. The figures are:

Percentage chloride elimination, a, b and c. 0.0739 to 0.133, average 0.107%; a, b, c and d, 0.0739 to 0.133, average 0.111%.

20 minute chloride elimination, a, b

and c, 0.0083 to 0.0163, average 0.0126 gm.; a, b, c and d, 0.0083 to 0.0222, average 0.0142 gm.

Regarding the salivary reaction, it is noted that the salivary methyl orange alkalinity in the series under consideration showed, in terms of tenth normal:

Series a, b c and d, for 100 cc. — 14.0 to 36.2, average 20.7; for 20 minutes — 1.37 to 4.15, average 2.4.

The changes in no way paralleled the phenolphthalein urinary acidity, either in 100 cc. or 20 minutes; nor do they vary inversely. There is apparently more relationship indicated by the hydrogen ion concentration. The pH for the animal diet is 7.2, in contrast to the pH for the vegetable diet, which is 6.8. The mixed diets are between these figures, regardless of the variation in salt administration. The average of all the pH observations is 6.97.[2] These figures vary in the opposite direction from the average phenolphthalein urinary acidity and from the average methyl orange alkalinity, but no expression of relationship holds when applied to the individual cases. Apparently the pH values give the more constant indication of the salivary reaction.

The salivary carbon dioxide varies as follows:

Series a, b, c and d, for 100 cc. — 12.7 to 50.6, average 29.7 cc. gas; for

TABLE 4

CHLORIDES

	grams per 100 cc.		*grams per 20 minutes*	
SUBJECT	URINE	SALIVA	URINE	SALIVA
a. Exclusive animal diet.				
E	1.60	.0739	.125	.0083
H	.82	.0962	.109	.0135
(average)	1.21	.0850	.117	.0109
b. Exclusive vegetable diet.				
E	1.85	.103	.134	.0136
H	1.20	.133	.080	.0133
I	1.00	.118	.064	.0148
(average)	1.35	.118	.093	.0139
c. Low salt mixed diet.				
E	1.30	.1125	.086	.011
H	.77	.097	.102	.0163
I	.32	.1205	.036	.0099
(average)	.80	.110	.075	.0124
d. High salt mixed diet.				
H	1.73	.126	.242	.0222
I	1.36	.130	.137	.0195
(average)	1.55	.128	.189	.0208

[2]Since the present article was written, Henry E. Starr has published (*Jour. Biol. Chem.*, 1922, LIV, 43-64) observations on salivary pH, in which he shows that centrifugalization in open tubes, as employed by us, increases the pH on an average 0.30 over the pH of mixed saliva collected under oil. The average pH obtained by this latter method Starr found to be 6.60. These figures correspond closely to our findings for centrifugalized saliva in open tubes.

TABLE 5

REACTIONS

Acidity and alkalinity expressed as 0.1 N.

	100 cc.				*20 minutes*		
	URINE		SALIVA		URINE	SALIVA	
SUBJECT	*Acidity*	*pH*	*Acidity*	*Alkalinity*	*Acidity*	*Acidity*	*Alkalinity*
a. Exclusive animal diet.							
E	72.4	7.2	.4	19.9	5.65	.04	2.33
H	64.3	7.2	2.8	17.9	8.55	.39	2.51
(average)	68.3	7.2	1.6	18.9	7.10	.22	2.37
b. Exclusive vegetable diet.							
E	34.7	6.8	1.1	36.2	2.51	.15	2.14
H	62.2	6.8	1.2	20.0	4.15	.12	2.00
I	14.3	6.9	1.2	14.0	.91	.15	1.75
(average)	37.1	6.8	1.2	23.4	2.52	.14	1.96
c. Low salt mixed diet.							
E	75.5	7.0	1.7	22.7	4.98	.17	2.22
H	33.7	6.8	1.7	19.7	4.48	.29	3.31
I	31.6	7.0	1.0	16.7	3.47	.08	1.37
(average)	46.9	6.9	1.5	19.7	4.31	.18	2.30
d. High salt mixed diet.							
H	30.6	6.8	2.2	23.6	4.28	.39	4.15
I	46.9	7.2	0.0	16.4	4.74	.00	2.46
(average)	38.8	7.0	1.1	20.0	4.51	.20	3.30

TABLE 6

CARBON DIOXIDE

	SALIVA	
SUBJECT	*cc. per 100 cc.*	*cc. per 20 minutes*
a. Exclusive animal diet.		
E	41.5	4.65
H	24.4	3.42
(average)	33.0	4.04
b. Exclusive vegetable diet.		
E	12.7	1.68
H	13.6	1.36
I	34.6	4.33
(average)	20.3	2.46
c. Low salt mixed diet.		
E	26.3	2.58
H	50.6	8.50
I	39.8	3.26
(average)	38.9	4.78
d. High salt mixed diet.		
H	35.0	6.16
I	18.8	2.82
(average)	26.9	4.49

20 minutes — 1.36 to 8.50, average 3.88 cc. gas.

It is lowest on the average during the exclusive vegetable diet and highest during the low salt mixed diet, but these variations are not constant.

The results do not indicate that the salivary ptyalin of the resting specimen is a function of the volume or time. That the activity is greater after the exclusive meat diet and least after the exclusive vegetable diet is a matter of surprise, but a reasonable explanation is not wanting.

TABLE 7

PTYALIN

SUBJECT	(1 gram unit) *100 cc.*	*20 minutes*
a. Exclusive animal diet.		
E	100.	11.
H	100.	14.
b. Exclusive vegetable diet.		
E	10.—	1.32—
H	30.	3.
I	1.—	.12—
c. Low salt mixed diet.		
E	10.—	1.—
H	100.	17.
I	100.	8.
d. High salt mixed diet.		
H	10.—	1.76—
I	100.	15.

In the saliva the nitrogenous ingredients are substances of diverse sources of origin. Thus, the mucin is a trophic product of the submaxillary and sublingual glands, while salivary ammonium is presumably derived as such from the blood, as also are urea, uric acid and creatinine, which latter two are not included in the present series of observations. This diversity of origin explains much variation in the saliva of the relative amounts of the different forms of nitrogen.

The mucin, so far as our provisional technic shows, is clearly a function of the time rather than volume. Note, for example, in specimen Hb how the mucin calculated to volume gives an amount nearly double Hc and yet calculated to time the amounts are nearly identical. While the mucin in the unit of time is nearly constant for the same individual, it differs with different individuals. Apparently it is a function not only of the unit of time but of the individual as well. Omitting Id for present consideration, for reasons already given, the percentage variations are 0.0024% to 0.0068%, average 0.0038%; 20 minute variations 0.3 to 0.7, average 0.5 mg. The 20 minute variations were not influenced by the dietary changes.

The total protein with H is more a function of the time and with E varies equally with volume and time, owing to the presence of very little protein other than mucin in the Ec specimen. The variations are 0.0028% to 0.0131%, average 0.0074%; 0.3 to 1.4, average 1.0 mg. in 20 minutes. It is notable that both E and H showed a strikingly high percentage protein elimination during the exclusive vegetable dietary period, which was compensated in H by lower volume secretion, but not in E.

Urea nitrogen appeared in only three of the ten examinations, and then in small amounts only. Its presence is

probably incidental rather than expressive of any constant variation of this substance in the saliva.

Ammonium nitrogen is present in notable quantity in all specimens. Its variations are proportional to volume rather than time, the amounts varying from 0.01099% to 0.023%, average 0.0162%, and 1.1 to 3.7, average 2.1 mgs. in 20 minutes. It was somewhat higher on animal and lower on vegetable diet, mixed diets being intermediate, irrespective of the salt. It paralleled the urinary ammonium only in the high ammonium of the animal diet, especially in the 20 minute period.

Non-protein nitrogen consists chiefly of the ammonium nitrogen and varies with volume. The amounts are 0.0129% to 0.0273%, average 0.0191%, and 1.3 to 3.9, average 2.5 mgs. in 20 minutes.

Total nitrogen is ordinarily a factor in part of the time, but largely of the volume, because of the greater predominance of ammonium. It varies from 0.0172% to 0.0337%, average 0.0265%, and from 1.8 to 5.3, average 3.5 mgs. in 20 minutes.

In this series parallel determinations of the total nitrogen, urea nitrogen and ammonium nitrogen of the urine have been made and calculated to the percentage and 20 minute quantities. A careful comparison of these results with the salivary determinations fails to show any convincing relationship, either of percentage or 20 minute quantities, as does also the comparison of the salivary nitrogens with the urinary or salivary reactions. To conserve space the reporting of the voluminous results of the urinary nitrogens is omitted.

In considering the thiocyanates it must be recognized that the method of determination is subject to possible error from confusing substances (5) (6). This source of error seems to be excluded in this series so far as relates to

TABLE 8

PARTITION OF SALIVA NITROGEN

Subject	*Total*		*Non-protein*		*Ammonium*		*Urine Ammonium*		*Urea*		*Protein*		*Mucin*	
	%	*20 min.*	*%*	*20 min.*	*%*	*20 min.*	*%*	*20 min.*	*%*	*20 min.*	*%*	*20 min.*	*%*	*20 min.*
a. Exclusive animal diet.														
E	.0307	.0034	.0273	.0031	.0203	.0023	.055	.0043	.0000	.0000	.0034	.0004	.0024	.0003
H	.0299	.0042	.0234	.0033	.0230	.0032	.067	.0089	.0000	.0000	.0065	.0009	.0040	.0006
(ave.)	.0303	.0038	.0254	.0032	.0217	.0028	.061	.0066	.0000	.0000	.0050	.0007	.0032	.0005
b. Exclusive vegetable diet.														
E	.0218	.0029	.0136	.0018	.0131	.0017	.053	.0038	.0000	.0000	.0082	.0011	.0030	.0004
H	.0301	.0030	.0170	.0017	.0135	.0014	.051	.0034	.0016	.0002	.0131	.0013	.0068	.0007
I	.0172	.0022	.0129	.0016	.0109	.0014	.024	.0015	.0000	.0000	.0043	.0005	.....	.....
(ave.)	.0230	.0027	.0145	.0017	.0125	.0015	.043	.0029	.0005	.0000	.0085	.0010	.0049	.0006
c. Low salt mixed diet.														
E	.0255	.0025	.0227	.0022	.0166	.0016	.055	.0036	.0017	.0002	.0028	.0003	.0027	.0003
H	.0247	.0041	.0162	.0027	.0151	.0025	.020	.0027	.0003	.0001	.0085	.0014	.0035	.0006
I	.0215	.0018	.0161	.0013	.0134	.0011	.037	.0042	.0000	.0000	.0054	.0004	.....	.....
(ave.)	.0239	.0028	.0183	.0021	.0150	.0017	.037	.0035	.0006	.0001	.0056	.0007	.0031	.0005
d. High salt mixed diet.														
H	.0300	.0053	.0225	.0039	.0209	.0037	.021	.0029	.0000	.0000	.0075	.0013	.0038	.0006
I	.0337	.0051	.0195	.0029	.0155	.0023	.063	.0064	.0000	.0000	.0142	.0021	.0101	.0015
(ave.)	.0319	.0052	.0210	.0034	.0182	.0030	.042	.0047	.0000	.0000	.0109	.0017	.0070	.0011

the ingestion by the subjects of confusing substances to subsequently pass into the saliva; and so far as relates to possible acidosis with salivary elimination of diacetic acid. An exception to the above is the known fact that each of these subjects smoked, except on the morning of saliva collections, throughout the periods of observations, E very moderately, I moderately and H considerably.

there was a compensating rise in percentage thiocyanate, so that the salivary elimination remained constant for the unit period of time.

With subject H, however, it appears that the time elimination shows the same variation as the percentage composition. A probable explanation of this is that the considerable smoking caused a variable increase of the thiocyanates produc-

TABLE 9

THIOCYANATES

SUBJECT	SALIVA *grams in 100 cc.*	*grams in 20 minutes*
a. Exclusive animal diet.		
E	0.0103	0.0012
H	0.0207	0.0029
(average)	0.0155	0.0021
b. Exclusive vegetable diet.		
E	0.0108	0.0014
H	0.0362	0.0036
I	0.0156	0.0019
(average)	0.0209	0.0023
c. Low salt mixed diet.		
E	0.0136	0.0013
H	0.0242	0.0041
I	0.0195	0.0016
(average)	0.0191	0.0023
d. High salt mixed diet.		
H	0.0294	0.0052
I	0.0132	0.0019
(average)	0.0213	0.0036

It will be noted that with subjects E and I the thiocyanates varied in percentage amounts but were reasonably constant in the 20 minute unit of time. This would seem to indicate that the thiocyanate salivary elimination is a function of the time rather than salivary volume. Note, for example, how when in subject I, periods c and d, the volume nearly doubled, the percentage composition of the thiocyanates fell, so that the 20 minute elimination remained nearly constant. So, too, with subject E, when the salivary volume fell, from the exclusive vegetable to low salt mixed diets,

tion in the system and that the salivary elimination in a unit of time was thus varied. Certainly, there was no effort on the part of the system to establish a uniform thiocyanate percentage composition at the expense of uniformity of time elimination, since both showed the same amount of variation. If this explanation is accepted, then it would seem to follow that the uniformity of time elimination is due to uniformity of production in the system rather than an effort of the system to produce uniformity of elimination.

Discussion

A study of the resting salivary flow subsequent to widely different dietaries, as indicated, reveals the fact that the *volume* of the flow is little influenced either by the urinary flow or by the character of the diet, excepting that a high salt dietary seems to distinctly increase the volume of flow in a given time.

The amount of *sediment* which the saliva contains, being composed chiefly of epithelial débris from the mouth, is determined by the condition of the oral mucosa and is greater earlier in the collection period, seeming to be washed out after a while when the sediment becomes distinctly less or almost absent.

In the saliva from which the sediment has been removed by centrifugalization it has been found that in general the salivary constituents have fallen into two classes:

(1) Those that tended to vary with the volume of the secretion. These include the inorganic solids or ash, the percentage of which remained remarkably constant irrespective of changes of volume; also the ammonium nitrogen and the chlorides. Further, since the ash, including the chlorides, and also the ammonium, made up such a considerable portion of the solids, the total solids have varied on the whole with the salivary volume rather than remained constant for the unit of time. Likewise, since the ammonium has made up such a considerable portion of the non-protein nitrogen and since the latter has made up such a considerable portion of the total nitrogen, those two, namely the non-protein and total nitrogen, have varied on the whole with the salivary volume, although none has shown the close parallelism that has the ash.

(2) Those that tended to show a constant amount for the unit of time, instead of varying with the volume. These are the organic solids, notwithstanding the inclusion of the ammonium that varies more with the volume, and particularly the nitrogen of mucin which, while varying in different individuals, has shown in the same individual a tendency to remain fixed for the unit of time that is almost as striking as is the constant relation of the ash to the volume. On the whole, the total protein should also be included in this class. Finally, the thiocyanates, as determined by the method employed, showed a constancy for a unit of time that doubtless is an indication of constant rate of production rather than of elimination. To the matter of ptyalin production we shall return later.

It will be noted that on the whole, with the constituents considered, the tendency has been for the products of secretory stimulation to vary with the volume and for the trophic products to be constant for a given time irrespective of changes of volume. We believe that this tendency has been sufficiently marked so as to present a valuable picture as to what is ordinarily to be expected in the composition of the resting salivary flow.

We have deferred consideration of the ptyalin because it presents features that are difficult to understand without having in mind much that has preceeded. It will be recalled that emphasis has already been given to the indication that the resting salivary flow is chiefly a product of secretory stimulation of the submaxillary and sublingual glands, to which is added, possibly by the mechanical stimulus of the movements of the mouth, some secretion of trophic products of these glands together with a minimum of secretory stimulation of the parotids; and that trophic products of the parotids are ordinarily very slight or even wanting. This latter is the essential condition, whether or not there is the limitation of secretory parotid flow that we have suggested. When it is further recalled that the chief source of salivary ptyalin is the secretion of the trophic

products of the parotids, it will be appreciated that the resting salivary flow should at no time give a true measure of the capacity of the individual to promote starch digestion.

If it should happen that there is little or no diastatic activity of such saliva, then one of two conclusions would be indicated; either that the individual was inflicted with a condition of partial or complete parotid atrophy; or that there was complete or nearly complete failure of elimination of trophic products, the secretion of such products being in a state of rest, and so far as there was parotid secretion at all that it was composed chiefly or solely of secretory products. In the series presented subject E showed the condition of trophic rest in two out of three specimens; H in one out of a total of four; and I one out of a total of three. That in these subjects the low or absent diastatic capacity did not indicate atrophy is evidenced by the existing diastic activity of the other specimens, being 1 unit per cc. of saliva, that is, each cc. having a digestive capacity of 1 gram starch, in five of the ten specimens, and 0.3 unit, corresponding to the digestion of 0.3 gram starch per cc. saliva, in the remaining specimen. We believe that the absence of ptyalin in any appreciable amount as found was merely a physiological conserving of this enzyme during the period of suspension of starch digestion.

If this view is correct, it will be fair to regard a high degree of ptyalin activity of the resting salivary flow as a failure to observe trophic secretory rest and hence as evidence of an abnormal if not actual pathological ptyalin waste—perhaps even accompanied by parotid trophic fatigue and loss of starch digestive capacity when demand is made upon such activity by the eating of food. That ptyalin trophic hyperactivity is in fact exhibited by certain individuals at certain times is evidenced in the studies of cases which follow. Moreover, the character of illness with which such individuals were suffering would strongly suggest the unphysiological character of the hyperactivity noted.

Part III. Pathological Cases Exhibiting Variations in Salivary Composition (7)

In the presentation of illustrative cases it is convenient to classify them relative to the salivary flow under the conditions that have been described in the present technic. We would suggest the term *sialosis* to express such flow, normal flow being indicated by the term *isosialosis,* increased flow by the term *hypersialosis* and diminished flow by the term *hyposialosis.*

The routine procedure with each case has been the establishment of the following:

1. Previous history.
2. Present clinical condition:
   a. General.
   b. Mouth.
3. Clinical laboratory findings:
   a. Examination of feces.
   b. Blood chemistry.
   c. Quantitative composition of the urine.
   d. Salivary composition.

To render the condition of alimentation and metabolism standardized and in a sense stabilized, patients have been uniformly put on a modified Schmidt-Strassberger diet in which the foods and daily amounts were: milk, 1 qt.; toast, 3 oz.; eggs, 2; butter, 1½ oz.; beef, ¼ lb.; boiled potato, 6 oz.; puffed rice, 2 oz.; sugar, ½ oz. On the third day of this standardized diet the 24 hours urine and the feces were collected. If the fecal discharge of the standard diet had not yet been reached (lampblack was used), the collection of feces was deferred till they were those of the standard diet. On the morning of the fourth day the salivary collection was made as described under the technic and immediately thereafter the specimens taken for the blood chemistry. In recent

examinations the urine from 8 A. M. to 11 A. M. has been collected on the morning of the saliva collection and calculated to 20 minutes' composition for comparison with the saliva. For the saliva the methods described in Part IV were employed; for the blood, feces and urine, recognized methods of exact analysis. In the protocols here presented we shall not give our results in full, but it will be understood that findings specified are based upon actual analytical data and in no instance are merely an expression of clinical opinion. Many of the negative findings are not reported.

Case 1. C. L. A., female, aet. 29, single, wt. 110 lbs., ht. 5′7″. Previous history: Tonsilectomy a year ago. Present clinical condition: *General.* Nervous; reflexes exaggerated. Anterior cervical curvature with inclination of shoulders. Abdominal ptosis. *Mouth.* Double protrusion. Malocclusion, Class I (Angle). (See illustrations, models of the teeth). Extractions: right and left inferior first molars, age 18. Mastication efficiency (206 inclined planes representing 100% in one complete excursion of mandible), 25.2%. No caries; no apical foci; acute pyorrhea, hyperemia, hemorrhage, pus with continuous pain. Tongue coated light gray.

Clinical laboratory findings: *Feces.* A hard formed amphoteric stool, giving a moderate reaction for occult blood and containing iodin positive grains of occasional occurrence and a moderate amount of unabsorbed soaps. B. coli and Gram positive cocci in unusually large number.

Blood chemistry. Urea and chlorides, normal; creatinine 3.0[3]; sugar, slightly low (0.076%).

25 hour urine. Volume, 1390 cc.; indican, large amount; combined sulfates, high (0.21 gm.; sulfate ratio 1:8.9); acidity, moderately strong (34.1 N); nitrogen partition: urea 72%, am.[4] 4.3%, uric acid 1.14%; chlorides, normal.

20 minute A. M. urine. Volume, 14.3 cc.; indican, large amount; acidity, moderately strong (0.48 N); solids, 4.4 — 0.63[5]; urea N, 0.89 — 0.127; am. N, 0.027 — 0.0039; chlorides, 0.50 — 0.072.

Saliva. See Record Chart I and Plot Chart.

Pathological diagnosis: Hemorrhage in the alimentary tract (bleeding gums). Intestinal toxemia. Hypertrophic isosialosis.

Subsequent to these examinations and the diagnosis as recorded, an extensive orthodontic apparatus with a Baker anchorage was introduced upon the teeth. It is to be anticipated that this would act as a mechanical salivary stimulus, increasing the secretory flow and even the trophic secretion in a case already hypertrophic. At the same time the diet was regulated to correct the intestinal toxemia.

Re-examination after an interval of one mouth showed:

20 minute A. M. urine. Volume, 33.9 cc.; indican, small amount; acidity, moderate (0.30 N); solids, 1.8 — 0.62; urea N, 0.44 — 0.150; am. N, 0.028 — 0.0095; chlorides, 0.51 — 0.173.

Saliva. See Record Chart II and Plot Chart.

Pathological diagnosis: Correction of the intestinal toxemia (reduction of the indican and lowered acidity). Hypertrophic hpyersialosis, the effect of the added mechanical stimulation incident to treatment.

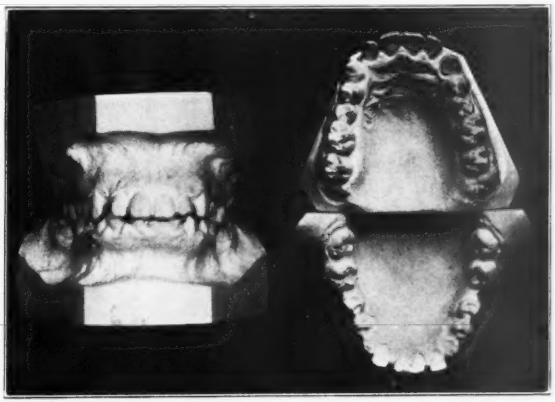
Case 2. M. L. F., male, aet. 38, tall, normal wt. Present clinical condition: *General.* Constipation. Muscle pains after exercise. Complained of periodic headaches and general malaise. Smokes considerably. *Mouth.* Malocclusion

[3]Blood figures are mgs. per 100 cc., unless otherwise stated.

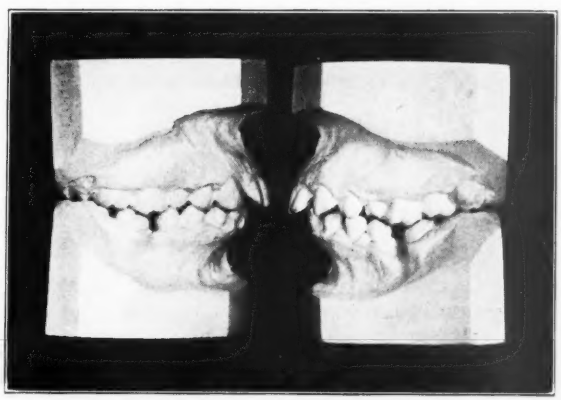
[4]Abbreviation for ammonium.

[5]Double figures are % and gms. in 20 minutes, unless otherwise stated.

due to mutilation. Missing teeth, many artificial teeth. Mastication efficiency 12.1%. Two devitalized teeth showing rarified areas. Recession of gums; anemic and glossy roof and gums; hyperemic floor. Tongue coated.



Case 1.



Case 1.

Clinical laboratory findings: *Feces.* A soft and pasty stool with moderately strong acidity, yielding 82% gas on fermentation and containing iodin positive grains in moderate number and a moderate amount of unabsorbed soaps. B. coli in unusually large number.

Blood Chemistry. Creatinine, 2.7; sugar, 0.08%; uric acid, 4.2.

22 hour urine. Volume, 1640 cc.; acidity, strong (50.8 N); uric acid, low (0.495 gm.).

Saliva. 20 minute volume, 28.5 cc.; alkalinity, 20.3 — 5.78.

Interval of 1 month

Saliva. 20 minute volume, 20.6 cc.; alkalinity, 16.4 — 3.4.

Interval of 25 days

Saliva. 20 minute volume, 22.3 cc.; alkalinity, 16.0 — 3.6.

cc.; indican, trace; oxalates in solution, not increased; acidity, low (0.26 N); solids, 3.6 — 1.29; chlorides, 0.92 — 0.33.

Interval of 1½ month

Saliva. 20 minute volume, 27.1 cc.; solids, 0.350 — 0.095; organic, 0.125 — 0.034; ash, 0.225 — 0.061; pH, 7.4;

Record Chart I—Case 1.

SALIVARY ANALYSIS

Patient Miss C. L. A. Date May 8, 1922

Consistency somewhat viscid Appearance turbid; greenish tint
Odor 'spitty,' soon becomes sour. Time 10:39-11:16;11:17-11:33;11:35-11:55; 73 minutes.

			In 100 cc. (Percentage)	In 20 minutes	Usual average 100 cc.	Usual average 20 min.
Mixed, whole saliva						
Quantity 42 cc.		cc.		11.5		12.
Specific Gravity	1.006					
Sediment; color greenish-yellowish		gms.	0.175	0.020		0.0278
Organic matter		gms.	0.150	0.017		0.0219
Ash		gms.	0.025	0.003		0.0059
Supernatant saliva						
Carbon dioxide		cc.gas	26.0	2.90	30	3.88
Hydrogen ion concentration (pH)	7.0				6.97	
Acidity to phenolphthalein	0.1 N	cc.	2.1	0.242	1.4	0.18
Alkalinity to methyl orange	0.1 N	cc.	20.8	2.392	17.0	2.21
Ptyalin		units	200.0	23.0	53.0	6.8
Solids		gms.	0.500	0.057	0.334	
Organic matter		gms.	0.250	0.028		0.0158
Ash		gms.	0.250	0.029	0.225	
Nitrogen, Total		gms.	0.0405	0.0046	0.0265	
Mucin		gms.				0.0005
Total protein		gms.	0.0028	0.0003		0.0010
Non-protein		gms.	0.0377	0.0043	0.0191	
Ammonia		gms.	0.0125	0.0014	0.0162	
Urea		gms.	0.0063	0.0007	0.	
Thiocyanates, as NH_4CNS		gms.	0.0055	0.0007		0.0020
Potassium		gms.	0.0525	0.0060	0.0900	
Sodium		gms.	0.0235	0.0027	0.0200	
Calcium		gms.	0.0084	0.0009	0.0100	
Chlorides, as NaCl		gms.	0.0985	0.0113	0.1070	

20 minute A. M. urine. Volume 20 cc.; indican, large amount; oxalates in solution, moderately large amount; acidity, low (0.14 N); solids, 5.5 — 1.09; chlorides, 1.3 — 0.26.

Interval of 1½ month

Saliva. 20 minute volume, 22.3 cc.; solids, 0.275 — 0.061; organic, 0.100 — 0.028; ash, 0.175 — 0.039; pH, 7.4; alkalinity, 17.4 — 3.9; ptyalin, 143 — 32 units; chlorides, 0.074 — 0.0165; thiocyanates, 0.014 — 0.003.

20 minute A. M. urine. Volume, 35.6 alkalinity, 20.4 — 5.5; ptyalin, 70 — 13 units; total N, 0.0198 — 0.0054; non-protein N, 0.0195 — 0.0053; am. N, 0.0053 — 0.0014; chorides, 0.0815 — 0.0221; thiocyanates, 0.0117 — 0.0032.

20 minute A. M. urine. Volume, 27.8 cc.; indican, none; oxalates in solution, small amount; solids, 5.2 — 1.44; chlorides, 1.2 — 0.33; acidity, moderate (0.32 N); urea N, 0.74 — 0.206; am. N, 0.034 — 0.009.

Pathological diagnosis: Hypersialosis. Occasional evidence of intestinal toxe-

mia. Urinary hyperacidity. Sluggish uric acid elimination.

Case 3. C. C. B., male, aet. 68, height medium, wt. 156 lbs.

Previous history: Urethral stricture (30 years).

Present clinical condition: *General.* denture. Mastication efficiency about 60%.

Clinical laboratory findings:

Examinations May 25

Blood chemistry. Urea N, high (24.7); creatinine, high (3.75); chlorides, high (0.53); sugar, high (0.17%).

Case 1.

SALIVARY ANALYSIS

Patient Miss C. L. A. Date June 9, 1922

Consistency watery Appearance somewhat turbid; brownish-
Odor very sour Time 11:04-11:49 = 45 minutes (yellowish

Mixed, whole saliva		In 100 cc. (Percentage)	In 20 minutes	Usual average 100 cc. 20 min.	
Quantity 46 cc.	cc.		20.4		12.
Specific Gravity 1.004					
Sediment; color greenish-yellowish	gms.	0.150	0.0506		0.0278
Organic matter	gms.	0.125	0.0255		0.0219
Ash	gms.	0.025	0.0051		0.0059
Supernatent saliva					
Carbon dioxide	cc.gas	26.9	5.49	30	3.88
Hydrogen ion concentration (pH) 7.0				6.97	
Acidity to phenolphthalein 0.1 N cc.		2.8	0.57	1.4	0.18
Alkalinity to methyl orange 0.1 N cc.		16.8	3.43	17.0	2.21
Ptyalin	units	300.0	61.2	53.0	6.8
Solids	gms.	0.450	0.0918	0.334	
Organic matter	gms.	0.225	0.0459		0.0188
Ash	gms.	0.225	0.0459	0.225	
Nitrogen, Total	gms.	0.0318	0.0065	0.0265	
Protein	gms.	0.0042	0.0009		0.0010
Non-protein	gms.	0.0276	0.0056	0.0191	
Ammonia	gms.	0.0014	0.0003	0.0162	
Urea	gms.	0.0053	0.0011	0.	
Thiocyanates, as NH_4CNS	gms.	0.0077	0.0016		0.0020
Potassium	gms.	0.1006	0.0205	0.0900	
Sodium	gms.	0.0446	0.0091	0.0200	
Calcium	gms.	0.0089	0.0018	0.0100	
Chlorides, as NaCl	gms.	0.0842	0.0172	0.1070	

Note Patient had eaten grape-fruit with sugar every morning for a week previous to this examination.

Chronic diabetic. B. coli, urinary cystitis with frequency. Renal deficiency.

Diet. For past 12 days on a meat and green vegetable diet, reducing the urinary sugar from 77 grams to none on the ninth day. 100 grams of sugar on the sixteenth day led to a glycosuria of 16.8 grams, which disappeared on the next day. Urotropin and am. benzoate medication.

Mouth. Mutilated dental arches, with caries. Tongue coated. Artificial

20 minute A. M. urine. Volume, 24 cc.; solids, 4.7 — 1.12; urea and am. N, 0.60 — 0.144; chlorides, 0.87 — 0.21; sugar, none.

Saliva. 20 minute volume, 17.9 cc.; solids, 0.34 — 0.061; organic, 0.100 — 0.018; ash, 0.24 — 0.043; pH, 7.0; alkalinity, 20.3 — 3.65; ptyalin, 100 — 17.9 units; non-protein N, 0.0226 — 0.004; urea N, 0.0005 — 0.0001; am. N, 0.014 — 0.0025; chlorides, 0.090 — 0.016; thiocyanates, 0.008 — 0.0015.

Examinations May 29; 100 gms. sugar taken May 28

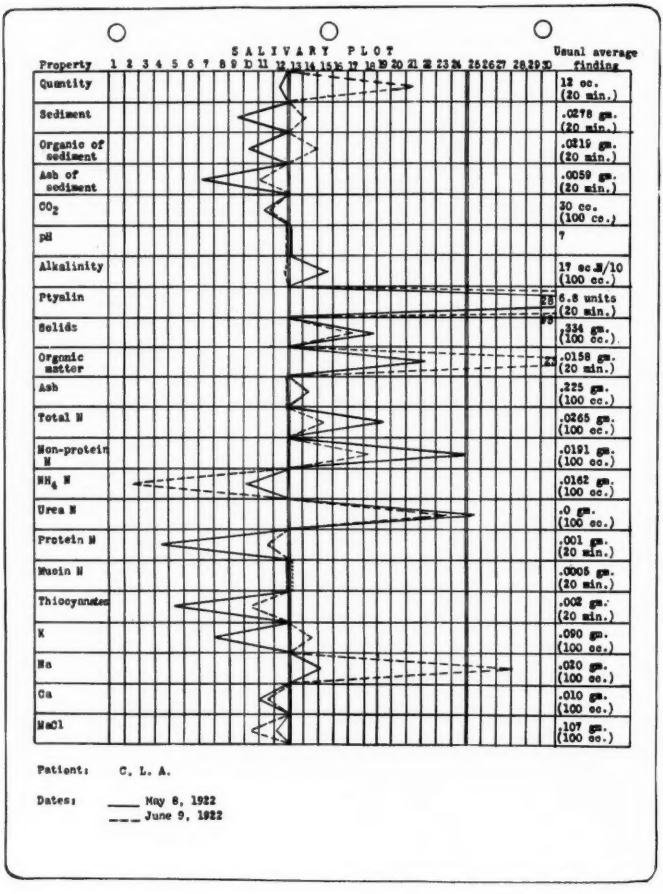
Blood chemistry. Urea N, high (38.4); creatinine, high (3.75); chlorides, high (0.54); sugar, high (0.22%).

20 minute A. M. urine. Volume, 13.3 cc.; solids, 4.9 — 0.65; urea and am. N, 0.78 — 0.103; chlorides, 0.92 — 0.122; sugar, none.

Saliva. 20 minute volume, 23.2 cc.; solids, 0.30 — 0.070; organic, 0.100 — 0.023; ash, 0.200 — 0.046; pH, 7.4; alkalinity, 15.4 — 3.57; ptyalin, 100 — 23.2 units; non-protein N, 0.025 — 0.0058; urea N, none; am. N. 0.0115 — 0.0027; chlorides, 0.074 — 0.017; thiocyanates, 0.0106 — 0.0025.

Pathological diagnosis: Hypersialosis. Retention in the blood of urinary ingredients.

Case 1.



Discussion: The special interest presented by this case is the effect of the high blood constituents in a chronic diabetic. The high blood chloride and urea apparently had little effect on the saliva; it seems possible that the high blood sugar acted as a secretory stimulus and is chiefly responsible for the hypersialosis.

Case 4. K. G. S., male, aet. 35. Present clinical condition: *General.* General physical depression. Intestinal toxemia. Chronic frontal headache, once or twice weekly, accompanied with partial blindness and gas in stomach. Stools are generally soft, regular daily. No medication, but castor oil about once in three months. Drank mineral water.

Natural diet selections. Reports he is fond of all foods. Does not care for highly seasoned food; eats no excessive salt, pepper or sugar. While fond of meat, does not eat more often than twice daily.

Mouth. Malocclusion, Class I (Angle), mutilated. Upper arch V-shaped. At 12 years of age had 3 teeth extracted owing to malocclusion. Mastication efficiency 11.6%.

Clinical laboratory findings: *Feces.* A soft and pasty stool with moderate acidity, yielding 100% gas on fermentation and containing iodin positive grains in moderate number and a moderate amount of unabsorbed soaps. B. coli in unusually large number.

Blood chemistry. Creatinine, 2.0; sugar, 0.07%; uric acid, 2.8.

24 hour urine. Volume, 1155 cc.; indican, high; oxalates in solution, moderately large amount; combined sulfates, moderate (0.170 gm., ratio 1.13); acidity, moderately strong (45.7 N); solids, 67.6 gm.; uric acid, low (0.394 gm.).

Saliva. 20 minute volume, 20 cc.; alkalinity, 19.4 — 3.88.

Interval of 7 weeks

Saliva. 20 minute volume, 11.4 cc.; alkalinity, 15.5 — 1.8.

20 minute A. M. urine. Volume, 26.7 cc.; indican, moderate amount; oxalates in solution, small amount; acidity, moderate (0.3 N); solids, 3.1 — 0.83; chlorides, 0.92 — 0.245.

Interval of 7 weeks

Saliva. 20 minute volume, 12.1 cc.; solids, 0.525 — 0.064; organic, 0.285 — 0.035; ash, 0.24 — 0.029; pH, 7.0; alkalinity, 17.7 — 2.14; ptyalin, 500 — 60.5 units; chlorides, 0.044 — 0.005; thiocyanates, 0.011 — 0.0013.

20 minute A. M. urine. Volume, 16.7 cc.; indican, moderate amount; oxalates in solution, large amount; solids, 5.2 — 0.87; chlorides, 1.3 — 0.22; acidity, moderate (0.204 N).

Interval of 3½ weeks

Saliva. 20 minute volume, 11.1 cc.; solids, 0.51 — 0.057; organic, 0.31 — 0.034; ash, 0.200 — 0.022; pH, 7.0; alkalinity, 20 — 2.22; ptyalin, 500 — 55.5 units; total N, 0.054 — 0.006; protein N, 0.0129 — 0.0014; urea N, 0.012 — 0.0013; am. N, 0.0066 — 0.0007; chlorides, 0.025 — 0.003; thiocyanates, 0.014 — 0.0016.

20 minute A. M. urine. Volume, 15 cc.; indican, moderately large amount; acidity, moderately strong (0.43 N); oxalates in solution, moderate amount; solids, 4.7 — 0.70; chlorides, 0.89 — 0.13.

Interval of 5 weeks

Saliva. 20 minute volume, 13.2 cc.; solids, 0.55 — 0.073; organic, 0.30 — 0.040; ash, 0.250 — 0.033; pH, 7.0; alkalinity, 20.3 — 2.68; ptyalin, 300 — 39.6 units; non-protein N, 0.027 — 0.0035; urea N, none; am. N, 0.017 — 0.0023; chlorides, 0.066 — 0.0087; thiocyanates, 0.029 — 0.0038.

20 minute A. M. urine. Volume, 10.8 cc.; indican, large amount; oxalates in solution, small amount; acidity, low (0.127 N,); solids, 5.5 — 0.59; urea N, 0.506 — 0.054; am. N, 0.04 — 0.004; chlorides, 1.3 — 0.14.

Pathological diagnosis: Hypertrophic isosialosis. Thiocyanates increased by

smoking. Gastro-intestinal toxemia with intervals of correction.

Case 5. D. S. M., male, aet. 53, single, average ht, underwt. Present clinical condition: *General.* Neurotic type, hereditary. Chronic intestinal toxemia, with marked intestinal fermentation and gas formation. As child had chronic periodic dizziness. Sensitive to draughts, sleeps well. Hemorrhoids. Addicted to self-medication.

Natural diet selections. 1 pt. milk, mornings with Hemaboloids. Fond of baked beans, stewed tomatoes, spinach, peas, spaghetti, string beans, potatoes hashed brown, celery, stewed peaches, ham, chicken.

Mouth. Occlusion of teeth good. Gums, roof and floor of mouth healthy. No caries. Tongue normal color. Mastication efficiency 56.3%.

Clinical laboratory findings: *Feces.* A soft formed stool, slightly acid, yielding no fermentation, giving a reaction, moderately strong, for occult blood and containing iodin positive grains in moderate number. B. coli in unusually large number.

Blood chemistry. Normal creatinine, sugar and uric acid.

24 hour urine. Volume, 1510 cc.; indican, large amount; oxalates in solution, small amount; acidity, moderately strong (44.4 N); solids, 43 gms.; uric acid, normal; chlorides, 6.34 gms.

Saliva. 20 minute volume, 11.1 cc.; alkalinity, 24.3 — 2.7.

Interval of 8 weeks

20 minute urine. Note: by error the collection of the "A.M." specimens in this case included the urine on rising and hence covered a period of 11½ hours instead of 3 hours. The calculation of the 20 minute amounts is made on this basis. Volume, 11.9 cc.; indican, large amount; oxalates in solution, large amount; acidity, moderately strong (0.41 N); solids, 5.2 — 0.62; chlorides, 0.75 — 0.089.

Saliva. 20 minute volume, 10.8 cc.; alkalinity, 22.9 — 2.5.

Interval of 6 weeks

20 minute urine. Volume, 12.75 cc.; indican, very large amount; oxalates in solution, large amount; acidity, strong (0.66 N); solids, 5.5 — 0.70; chlorides, 1.35 — 0.172.

Saliva. 20 minute volume, 9.4 cc.; pH, 7.6; alkalinity, 26.4 — 2.48; ptyalin, 25 — 2.4.

Interval of 9 weeks

Saliva. 20 minute volume, 16.9 cc.; alkalinity, 22 — 3.7.

Interval of 2 days

20 minute urine. Volume, 14.2 cc.; indican, moderately large amount; oxalates in solution, small amount; acidity, moderately strong (0.41 N); solids, 6.2 — 0.89; urea N, 0.778 — 0.11; am. N, 0.018 — 0.0026; chlorides, 1.38 — 0.196.

Saliva. 20 minute volume, 17.6 cc.; solids, 0.35 — 0.062; organic, 0.200 — 0.035; ash, 0.150 — 0.026; pH, 7.4; alkalinity, 20.1 — 3.54; ptyalin, 10 — 0.18 units; total N, 0.034 — 0.0059; non-protein N, 0.025 — 0.0044; urea N, 0.006 — 0.0011; am. N, 0.011 — 0.0019; chlorides, 0.0575 — 0.0101; thiocyanates, 0.007 — 0.0013.

Pathological diagnosis: Isotrophic isosialosis. High pH with high urinary acidity; gastro-intestinal toxemia.

Case 6. M. F., female, aet. 21, single, wt. 123 lbs., ht. 5′4″. Previous history: Diphtheria, scarlet fever, pneumonia, 11 — 13 years of age. Present clinical condition: *General.* Normal healthy type; athletic.

Mouth. Normal occlusion of teeth. Mastication efficiency 95%. Normal gums, roof and floor of mouth.

Clinical laboratory findings: *Feces.* A formed stool of medium consistency, slightly acid, giving a strong reaction for occult blood, containing a small number of iodin positive grains and a small amount of unabsorbed soaps. B.

coli are in unusually large number and Gram positive cocci in moderately large number.

Blood chemistry. Creatinine, 2.7; uric acid, 4.3; sugar, 0.08%.

24 hour urine. Volume, 1345 cc.; indican, moderate amount; oxalates, small amount; combined sulfates, low; acidity, moderate (29.6 N); uric acid, low (0.348 gm.); chlorides, low (5.38 gms.).

Saliva. 20 minute volume, 12.8 cc.; alkalinity, 17.4 — 2.23.

Pathological diagnosis; Isosialosis; sluggish uric acid elimination; hemorrhage in alimentary tract, unexplained; high B. coli and Gram positive fecal flora.

Case 7. D. P., female, aet. 23, wt. 128 lbs., ht. 5′6″. Present clinical condition: *General.* Intestinal putrefaction and fermentation. Constipation; headache; general malaise. Large consumer of sodium chloride and fried food.

Mouth. Normal occlusion. Mastication efficiency 80%. Gums, roof and floor healthy.

Clinical laboratory findings: *20 minute A. M. urine.* Volume, 13.3 cc.; indican, large amount; oxalates in solution, not increased; acidity, moderate (0.157 N); solids, 2.1 — 0.28; chlorides, 0.44 — 0.06.

Saliva. 20 minute volume, 6.8 cc.; alkalinity, 26.8 — 1.82.

Interval of 10 days

20 minute A.M. urine. Volume, 8.3 cc.; indican, small amount; oxalates in solution, not increased; acidity, low (0.11 N); solids, 1.56 — 0.13; chlorides, 0.44 — 0.037.

Saliva. 20 minute volume, 4.7 cc.; alkalinity, 32.8 — 1.54.

Interval of 3 months

Saliva. 20 minute volume, 11.6 cc.; solids, 0.500 — 0.058; organic, 0.225 — 0.026; ash, 0.275 — 0.032; pH, 6.4; alkalinity, 25.5 — 2.96; ptyalin, 300 — 35 units; total N, 0.040 — 0.0046; non-protein N, 0.038 — 0.0044; urea N, 0.0009 — 0.0001; am. N, 0.016 — 0.0019; thiocyanates, 0.005 — 0.0006.

Pathological diagnosis: Hypertrophic hyposialosis. Low pH (high hydrogen ion concentration). Intestinal toxemia.

Case 8. K., male, aet. 60, ht. about 5′9.5″, wt. about 170 lbs. Present clinical condition: Suffering from a mild form of mental disease. Extremely apprehensive.

Clinical laboratory findings: *Feces.* A soft, pasty stool, faintly acid, giving a strong reaction for occult blood and 100% fermentation, and containing no iodin positive grains, but a moderate amount of unabsorbed soaps. B. coli are unusually abundant.

Blood chemistry. Urea, creatinine, sugar and chlorides normal. Uric acid, slightly high (4.0).

33 hour urine. Volume, 2900 cc.; trace of albumin and small number hyaline and finely granular casts; indican and oxalates and combined sulfates, normal; acidity, moderate (54.1 N); uric acid, normal.

20 minute A.M. urine. Volume, 24.2 cc.; acidity, moderately strong (0.50 N); solids, 3.9 — 0.95.

Saliva. 20 minute volume, 7.8 cc.; solids, 0.55 — 0.043; organic, 0.35 — 0.027; ash, 0.20 — 0.016; pH, 7.2; alkalinity, 22.8 — 1.78; ptyalin, 1000 — 78 units; total N, 0.059 — 0.0047; non-protein N, 0.030 — 0.0024; urea N, 0.018 — 0.0014; am. N, 0.004 — 0.0003; chlorides, 0.085 — 0.0066; thiocyanates, 0.0077 — 0.0006.

Pathological diagnosis: Hypertrophic hyposialosis. Mild renal defect with sluggish uric acid elimination. Occult fecal blood from alimentary lesion, not known.

The illustrative cases present certain interesting conditions. Cases 2 and 3 show hypersialosis that is purely secretory, that is, without ptyalin increase.

Case 4 shows normal sialosis with an increase of the trophic ptyalin.

Cases 7 and 8 show hyposialosis, but with an increase of the trophic ptyalin.

Case 5 shows neither trophic nor secretory increase.

These varying conditions are closely associated with the nature of the innervation of the secreting glands. It is well known that a predominating autonomic stimulation increases the volume of secretion and that a predominating sympathetic stimulation tends to inhibit salivary flow; also that the nature of the innervating stimulus determines trophic activities. We have not attempted in the limits of this presentation to accurately define these applications, but enough has been said to suggest the possible value of salivary analysis in diagnosing the type of nervous unbalance with which a given patient may be affected. We are aware that it will require much more extended observation to clearly differentiate all such diagnostic possibilities and even to fully justify some of the conclusions that have been suggested. We believe, however, that the results presented indicate a direction of investigation that is well worth the attention of those devoted to this field of work.

Definitions of Terms

sialosis (si-al′-o-sis) [Gr. σίαλον, spittle + -osis (Gr. -ωσις), termination denoting a process, action or condition]. (Sialology) The flow of saliva. Adj. *sialotic* (si-a-lot′-ic).

isosialosis [Gr. ἴσος, equal + sialosis, q.v.]. (Sialology) The normal flow of saliva; specifically, such a flow as is normally produced without unnecessary stimulation of any kind and with a condition of resting metabolism. The term refers purely to the normal flow of saliva as produced under secretory stimulation, together with the degree of secretion of trophic products that normally accompanies such salivary flow. Adj. *isosialotic.*

hypersialosis [Gr. ὑπέρ, above + sialosis, q.v.]. (Sialology) An increased flow of saliva, whether physiological or pathological or induced by drugs (sialagogues). Adj. *hypersialotic.* Snyonyms: sialorrh(o)ea, salivation, ptyalism, sialismus.

hyposialosis [Gr. ὑπό, under + sialosis, q.v.]. (Sialology) A diminished flow of saliva. Adj. hyposialotic. Synonym: sialaporia.

isotrophic [Gr. ἴσος, equal + trophic (Gr. τροφικός, pertaining to nutrition)]. (Sialology) Marked by the presence of normal amounts of trophic products, e.g., ptyalin or mucin.

hypertrophic [Gr. ὑπέρ, above + trophic, as above]. (Sialology) Marked by the presence of increased amounts of trophic products, e.g., ptyalin or mucin.

hypotrophic [Gr. ὑπό, under + trophic as above]. (Sialology) Marked by the presence of diminished amounts of trophic products, e.g., ptyalin or mucin.

sialology. The scientific study of the secretion of the saliva and its physical and chemical composition and properties in normal and pathological conditions. (New Standard Dictionary, 1922).

Part IV. Technic of Salivary Analysis

1. Collection of the Specimen

The patient abstains from food or medication from the time of evening meal until 11 A. M. the next day, a glass of water being allowed at 7 or 8 A. M. The collection of the specimen is conducted in a room free from odors or sights that might occasion thoughts of food, either pleasant or unpleasant, and is begun at 11 A. M. No mechanical or other form of accessory stimulation of the salivary flow is employed. All saliva that enters the mouth is collected in an opaque cup, swallowing being avoided throughout the period of collection. No undue mental stimulation, such as counting the expectorations, reading, talking or exposure to strong light is permitted. The collection is discontinued when 40 cc. have been obtained. The patient should report the taste, if any. The time of beginning and

ending the collection is accurately noted and the exact time of collection recorded.

In the routine collection of saliva, cases may occur whose flow is so slow that the collection of 40 cc. is impracticable. Hence, the rule may be adopted to continue the collection as described, if not more than 75 minutes is required, at the end of which period the collection is discontinued and the analysis limited to the more important determinations, as the amount collected will permit. With slow flow the more concentrated saliva will permit the use of smaller quantities in some of the determinations.

2. Description of the Specimen

a. *Volume:* Immediately after the delivery, the saliva is well mixed and the volume measured in cc. The amount of froth is noted. The delivery for 20 minutes, unit of time, is obtained from the equation:

$$\frac{\text{Volume (cc.)} \times 20}{\text{Collection time (minutes)}} = \text{Quantity in 20 minutes}$$

b. *Appearance:* Note whether clear, transparent, translucent (normal), opalescent or turbid.

c. *Consistency:* Record as watery or thin (normal), stringy or viscid.

d. *Odor:* Record as inodorous (normal), sickly sweet, sour or fetid, ammoniacal, drugged (describe).

e. *Color:* Record as colorless (normal), yellow, red (blood tinged), brown and whether the color is that of the fresh specimen or developed on standing.

3. Specific Gravity

Method:

Specific gravity is determined with a Ferris Modified Saxe Hydrometer, in which the saliva is contained within the hydrometer, which is floated in distilled water.

Alternate methods are the use of the Westphal balance or of a standardized urinometer (the usual urinometers on the markets are commonly inaccurate), the readings of which are separated by not less than 1/20 inch.

Procedure:

With a pipette fill the bulb of the Ferris hydrometer; cool the whole to 15.6°C.(60°F.); then with a rolled wisp of absorbent cotton remove any bubbles of saliva and lower the surface of the liquid until the lower meniscus is brought accurately to the line. Immerse the hydrometer in distilled water at 15.6°C.(60°F.) so that no air bubbles adhere to it, and spin, keeping it free from the sides of the vessel. Read the specific gravity as given on the stem of the hydrometer; spin and read again to verify the first reading.

Occasional check readings should be made with distilled water.

Determinations with the Westphal balance or standardized urinometer are conducted in the usual way, care being taken to bring the temperature to 15.6°C. (60°F.).

Centrifugalization

Procedure:

Reserve sufficient of the whole saliva so that 2 cc. may be measured out for the Total Solids (or, even better, measure out this portion at once. See under Total Solids). All the remaining specimen is at once centrifugalized, conveniently by distributing into two tubes, till the sediment is well separated, leaving a clear supernatant liquid. 5 minutes at 1500 revolutions a minute usually suffices. The clear liquid is at once poured off and is used for all subsequent determinations.

4. Carbon dioxide

Method:

This determination is made without delay. The technic is an adaptation of that of Henderson and Morriss for blood. (1).

Reagents:

1. 20% tartaric acid solution.
2. 10% sodium hydroxide solution.
3. 1% hydrochloric or other acid.

Procedure:

The use of ammonia solution for laking is omitted, but 2 or 3 cc. of CO_2—free distilled water should be put in the diffusion tube (which must hold no more than 28 cc.) in its place.

As subsequently recommended by these authors, 1 cc. of alcoholic 1% phenolphthalein and alcohol to make the alcoholic strength 10% are advantageously added to the water in the burette of the absorption apparatus, which is acidulated with a few drops (1%) of hydrochloric or other acid. The alcohol affords more rapid draining and hence allows quicker readings without loss of accuracy, while the indicator detects any accidental drawing over into the burette of the alkali absorption solution.

In drawing the carbon dioxide from the diffusion tube into the absorption burette, the end of the tube is lifted sufficiently to admit a bubble of air, which is then used to wash the last portion of the air in the tube into the burette.

Ordinarily it is not important to correct for barometric pressure, but temperature corrections are made as for blood. One-tenth the amount is added to the volume of gas found in the analysis to compensate for carbon dioxide remaining in solution.

A blank determination should be run with pure sodium carbonate made up from the dried recrystallized salt to a solution of appropriate strength. Duplicate analyses should agree to within 0.03 cc.

5. Hydrogen ion concentration

Method:

Colorimetric, by comparison with standard solutions, bromthymol blue indicator. We have made use of the LaMotte hydrogen ion comparator set.

Reagents:

1. The hydrogen ion comparator set, covering the range 6.0 to 7.6, bromthymol blue indicator.
2. Bromthymol blue indicator solution.

Procedure:

In the extra graduated tube of the comparator set dilute 1 cc. saliva to 10 cc. with recently boiled distilled water and add 0.5 cc. of the indicator. Compare the shade produced with the standard tubes and note the pH from the tube which matches.

6. Alkalinity

Method:

By titration with standard acid, methyl orange indicator.

Reagents:

1. 0.02 N hydrochloric acid.
2. 0.02% methyl orange solution in distilled water, neutralized.

Procedure:

To 2 cc. saliva, accurately measured with an Ostwald pipette into a small porcelain dish, add one drop Reagent 2 and from a pipette or burette graduated to 0.01 cc. Reagent 1 to the beginning of the permanent color of rose.

Calculation:

(1) no. cc. Reagent 1 required $\times$ 10 = 0.1 N alkalinity per 100 cc. saliva.

(2) $\dfrac{\text{0.1 N alkalinity per 100 cc.} \times \text{vol. in 20 minutes}}{100}$ = 0.1 N alkalinity in 20 minutes.

7. Titratable acidity

Method:

By titration with standard alkali, phenolphthalein indicator.

Reagents:

1. 0.02 N sodium hydroxide, free from carbonate.
2. 1% phenolphthalein, neutral alcoholic solution.
3. Potassium oxalate, neutral salt, as tested by solution and blank titration with Reagent 1.

Procedure:

Into each of 2 suitable containers (test tubes may be used, in which case the comparison may be made against a

white background), introduce 1.5 gms. Reagent 3 and 3 drops Reagent 2. Into A accurately measure (Ostwald) 2 cc. saliva; into B an equal amount of water. Shake for 1 or 2 minutes. While still cold, titrate B with Reagent 1 to a permanent pink color and A to a color that just matches that of B.

Calculation:

Subtract the amount of B titration from that of A. The difference is the 0.02 N titration of 2 cc. Then,

(1) 0.02 N titration $\times$ 10 = 0.1 N titratable acidity per 100 cc. saliva.

(2) $\text{0.1 N acidity per 100 cc.} \times \frac{\text{vol. in 20 minutes}}{100}$ = 0.1 N titratable acidity in 20 minutes.

8. Ptyalin

Method:

The degree of ptyalin activity measured is the quantity of ptyalin that will just cause a disappearance of iodin color-producing substance, under the conditions described, in 20 mgs. potato starch contained in 5 cc. solution, with a stabilized hydrogen ion concentration corresponding to pH 6.7 and with electrolytes furnished by the presence of 0.05% sodium chloride. The quantity of saliva that produces this result is arbitrarily regarded as containing one-fiftieth unit of ptyalin, the unit being the quantity of ptyalin that will digest 1 gm. of starch under the conditions outlined.

Reagents:

1. Standard starch-pH 6.7-NaCl solution.

To solution a, when cool, add exactly 50 cc. of solution b and 25 cc. of solution c and add distilled water to bring the volume of the mixture to exactly 400 cc. The reagent should be freshly prepared.

Solution a. Potato starch solution. In a suitable beaker or casserole thoroughly mix with about 10 cc. cold distilled water washed and partially dried potato starch (8, p. 309) in amount exactly equivalent to 2 gms. dry starch; add about 100 cc. boiling distilled water and boil gently with constant stirring for five minutes.

Solution b. Standard buffer solution, pH 6.7. This is prepared as described by W. Mansfield Clark (9). 50 cc. M/5 acid potassium phosphate (p. 70) and 21 cc. M/5 sodium hydroxide solution (p. 71) are accurately delivered into a 200 cc. volumetric flask and the contents brought to exact volume with distilled water.

Solution c. Sodium chloride solution, 1%. 10 gms. of the dried, chemically pure salt are dissolved in distilled water and brought to the volume of 1000 cc.

2. Iodin solution, 0.001 N. Dilute 1 cc. 0.1 N iodin solution (8, p. 561) to 100 cc. with distilled water. The dilution should be prepared on the day used.

3. Diluted saliva.

a. Dilution 1 to 5. To 2 cc. saliva, accurately delivered from an Ostwald pipette, add accurately measured 8 cc. distilled water. Mix thoroughly.

b. Dilution 1 to 50. To 1 cc. saliva dilution a, accurately delivered from an Ostwald pipette, add accurately measured 9 cc. distilled water. Mix thoroughly.

Procedure:

In each of two suitable racks place 10 test tubes, 5/8″ $\times$ 5″, numbered from 10 to 1. Into the successive tubes of rack (a) accurately pipette the indicated reagent solutions, using for the diluted saliva and for the water pipettes or burettes graduated to 0.01 cc.

Into the successive tubes of rack (b) reagent solutions are similarly pipetted, excepting that saliva dilution (b) replaces saliva dilution a. In each instance the additions are in the order of reagents indicated and the addition of Reagent 1 should follow the order of the numbering of the tubes.

Number of tube	10	9	8	7	6	5	4	3	2	1
Saliva dilution a, cc.	0.10	0.11	0.125	0.14	0.17	0.20	0.25	0.33	0.50	1.00
Water, cc.	0.90	0.89	0.875	0.86	0.83	0.80	0.75	0.67	0.50	0.00
Reagent 1, cc.	4	4	4	4	4	4	4	4	4	4

It is usually desirable to allow an interval, say of 10 minutes, between the running of the racks, in which instance the addition of Reagent 1 to (a) or (b), as the case may be, should be deferred till the expiration of this interval. Further, in working with saliva whose ptyalin activity is approximately known it may be possible to limit the procedure to the particular rack in which it is known that the color end point will be obtained.

Immediately upon the addition of Reagent 1, thoroughly mix the contents of the tubes (important) and place in a water bath previously brought to 40°C., exactly maintaining this temperature throughout the operation.

In exactly 30 minutes from the time Reagent 1 is delivered into the first tube remove the rack from the bath, shake well (important) and immediately test the mixtures by transferring with a 1 cc. pipette 1 cc. of each in the same order in which Reagent 1 was added to a corresponding set of tubes into which has previously been measured 1 cc. of Reagent 2. The same 1 cc. pipette may be used for this transfer without rinsing. Note any iodin coloration immediately.

Ordinarily the tubes containing the largest amounts of saliva will give no coloration with iodin, the succeeding tubes a reddish or pink color and the remaining tubes a blue color. The tube that fails to give a color reaction that is adjacent to the tube that does give a color reaction has in it the amount of saliva that contains one-fiftieth unit of ptyalin. The number of this tube indicates the number of units ptyalin per cc. saliva for rack b; and, when divided by 10, the number of units per cc. for rack a.

When an interval is allowed in the addition of Reagent 1 between the running of the racks, the same interval will obviously occur in the removal and testing of the color reaction.

If it happens that all of the tubes in rack (a) give a color reaction, the conclusion is indicated that the saliva contains less than one-tenth unit of ptyalin per cc. A series of 5 tubes, numbered successively 5 to 1, may then be run, into which are introduced successively 0.20, 0.25, 0.33, 0.50 and 1 cc. of undiluted saliva; 0.80, 0.75, 0.67, 0.50 and 0.0 cc. respectively of distilled water; and in each tube 4 cc. Reagent 1. The number of the tube giving a negative color reaction containing the least quantity of saliva will indicate the number of units ptyalin contained in 50 cc. saliva.

As an unusual occurrence the ptyalin activity of the specimen may be sufficiently great so that the color reaction fails throughout both racks (a) and (b). In that event the operation should be repeated, using for the saliva solution a 1 to 500 dilution, prepared either by diluting 1 cc. of solution (b) to 10 cc., in the manner already described for the preparation of dilution b, or by diluting 1 cc. of original saliva to 500 cc. In this dilution the number of the negative tube multiplied by 10 will give the number of units ptyalin per cc. in the original saliva.

It is apparent that variations of the method by suitable dilutions of the saliva are possible that will permit of determinations between the readings of tubes, as above outlined. Ordinarily greater accuracy than that indicated is not of clinical value.

Calculation:

(1) units ptyalin in 1 cc. saliva × 100 = units ptyalin per 100 cc. saliva.

(2) units ptyalin per 100 cc. $\times$ vol. in 20 minutes / 100 = units ptyalin in 20 minutes.

9. Solids, Organic Matter and Ash

Method:

Total solids, organic matter and ash are determined by the usual methods of evaporation and ignition on both the whole mixed saliva and the centrifugalized saliva. The amounts in the sediment are estimated by difference.

Procedure:

Two platinum, silica or, less desirably, porcelain flat-bottom dishes or capsules are brought to constant weight by ignition and cooled ½ hour in a desiccator. Into one weighed dish (A) introduce with an Ostwald pipette 2 cc. of the well mixed whole saliva, and into the second weighed dish (B) 2 cc.[6] of the supernatant centrifugalized saliva. Evaporate on a water-bath, and dry in an oven at 100° C. for 1 hour. Cool in the desiccator ½ hour and weigh. Increase in weights represents amounts of total solids for whole and centrifugalized saliva respectively; the difference in the solids of B and A is the weight of the sediment. Heat the dishes over a flame, not above dull red heat, until the color has become white; cool in the desiccator for ½ hour and weigh. These weights, less the weights of the dishes, represent ash. The differences between total solids and ash are organic matter in the whole (A) and centrifugalized (B) saliva. The difference in the organic matter and ash respectively of B and A are the organic matter and ash of the sediment.

Calculation:

(1) findings $\times$ 50 = per cent.

(2) Per cent. $\times$ vol. in 20 minutes / 100 = amount in 20 minutes.

[6]The quantity of saliva taken may be the whole amount to be subsequently used for determination of the mineral bases and the residue then used for such determinations and the calculation adjusted accordingly.

10. Total Nitrogen

Method:

This is an adaptation of the microchemical method used in blood analysis, which in turn is an adaptation of the Gunning-Kjeldahl method. Nitrogenous matter is oxidized by heat in the presence of potassium sulfate, copper sulfate and sulfuric acid, the ammonia liberated by alkalization, the solution aerated, the ammonia absorbed by hydrochloric acid and the quantity determined by Nesslerization.

Reagents:

Note. All reagents should be of the highest degree of purity (nitrogen-free). For details and apparatus see (3), (pp. 32-33).

1. Potassium sulfate powder.
2. 10% copper sulfate solution.
3. Concentrated sulfuric acid.
4. 0.1 N hydrochloric acid.
5. Saturated solution of sodium hydroxide.
6. Standard nitrogen solution, containing 1 mg. N per 5 cc. Disolve 0.944 gm. ammonium sulfate or 0.764 gm. ammonium chloride (highest purity, dry salt) in distilled water and make up the volume to exactly 1000 cc.
7. Modified Nessler solution (Bock and Benedict formula).

Procedure:

Into the glass digestion tube of the Myers aeration apparatus accurately pipette (Oswald) 2 cc. of saliva and add approximately 0.2 gm. Reagent 1, 2 drops Reagent 2, and 0.3 to 0.5 cc. Reagent 3. Heat over a microburner flame, continuing the digestion for at least 2 minutes after the mixture becomes colorless. When the dense fumes of acid begin to come off, the tube may be stoppered with loose absorbent cotton. After cooling for a few minutes add about 6 cc. distilled water.

Into the graduated 100 cc. cylinder of the aeration apparatus put 2 cc. of Reagent 4 and 15 cc. distilled water. Adjust the aeration apparatus, place the

digestion tube in the first cylinder, deliver 3 cc. of Reagent 5 so that it will flow down the inside of the digestion tube, underlying the diluted digest solution, and immediately stopper in position in the apparatus. Aeration at the highest speed is continued for ½ hour.

Disconnect the graduated cylinder, rinsing well the aeration tube into the acid contents of the cylinder, add about 8 cc. freshly diluted (1 to 5) Reagent 7, and bring to a suitable volume with distilled water—40 cc. is usually convenient. If highly colored, corresponding greater dilution should be made.

Into a 100 cc. volumetric flask accurately pipette 5 cc. Reagent 6, add about 50 cc. distilled water and 20 cc. freshly diluted (1 to 5) Reagent 7, finally bringing the volume to exactly 100 cc. with distilled water for the comparison standard.

The comparison of the unknown solution from the saliva with the standard is made in a colorimeter (Bock-Benedict, Duboscq or Kober) in the usual way (ordinarily set at 20).

Calculation:

S = reading of standard.

R = reading of unknown found by comparison.

D = dilution of unknown after the addition of Nessler solution.

$$(1)\quad \frac{S \times D}{R \times 2} = \text{mgs. N per 100 cc. saliva.}$$

It it well to make a blank determination and introduce a correction (C) for the result then obtained, such a correction being deducted from the mgs. N found. Then (1) becomes

$$(2)\quad \frac{S \times D}{R} - C \times \frac{1}{2} = \text{mgs. N per 100 cc. saliva.}$$

$$(3)\quad \frac{\text{Mgs. N per 100 cc.} \times \text{vol. in 20 minutes}}{100} = \text{mgs. N in 20 minutes.}$$

Note. As a series of half a dozen or more aeration processes may be conducted at one time, it is convenient to plan the work so that aeration as well of the ammonia and urea nitrogen determinations that follow may be conducted at the same operation, unless, indeed, the total nitrogen digestion is for convenience deferred, which may be done after the acid is added, if the tube is well stoppered.

11. Ammonium Nitrogen

Method:

An adaptation of the micro-chemical aeration method commonly employed in blood and urine analysis (3), (p. 109). The determination should be made the day the specimen is collected.

Reagents:

1. Caprylic alcohol.
2. Sodium carbonate, saturated solution (about 22%).

Procedure:

Accurately pipette 2 cc. saliva into the digestion tube of the aeration apparatus, add about 4 cc. distilled water, 2 or 3 drops Reagent 1 and 4 cc. Reagent 2. Aeration and Nesslerization are carried out as under Total Nitrogen.

Calculation:

As for Total Nitrogen, excepting that a correction, determined by a blank under the conditions of the ammonium aeration, is to be used.

12. Urea Nitrogen

Method:

An adaptation of the micro-chemical urease aeration method commonly employed in blood and urine analysis (3), (p. 34). Ammonium nitrogen is deducted from the nitrogen thus obtained. The determination should be completed the day the specimen is collected.

Reagents:

1 and 2 as in ammonium nitrogen determination.

3. Urease tablets, 0.1 gm. each. As purchased, these contain the activating phosphate.

Procedure:

Dissolve a tablet (Reagent 3) in 2 cc. water in the digestion tube of the aeration apparatus, into which is then accurately pipetted 2 cc. of saliva, and place the tube in water at 50°C. for 15 minutes. At the expiration of this time add 2 or 3 drops Reagent 1 and 4 cc. Reagent 2. Aerate and Nesslerize as under Total Nitrogen.

Calculation:

As for Total Nitrogen, excepting that a correction, determined by a blank under the conditions of the present aeration, is to be used. Finally, from the results thus obtained the ammonium nitrogen is deducted, the remaining nitrogen being that of urea.

13. Mucin Nitrogen (Provisional)

Method:

Mucin is precipitated by acetic acid and nitrogen determined in the supernatant fluid. The difference between the total nitrogen (No. 10) and the nitrogen thus determined is the nitrogen of mucin.

Reagent:

1. Acetic acid, glacial.

Procedure:

To 5 cc. saliva in a 15 cc. centrifugal tube add 0.1 cc. Reagent 1 and tightly stopper. The next day centrifugalize the tube and contents (the stopper is removed) and determine the nitrogen, as under No. 10, in 2 cc. of the clear supernatant liquid.

Calculation:

Calculate the nitrogen as under Total Nitrogen (No. 10) and subtract the result from the total nitrogen already determined. The difference is nitrogen of mucin.

14. Non-protein Nitrogen

Method:

The remaining portion of the demucinized saliva is deproteinized with methyl alcohol and the non-protein nitrogen in solution determined.

Reagent:

1. Methyl alcohol, C. P.

Procedure:

To 2 cc. of the demucinized saliva prepared under No. 13, accurately measured, add an equal volume of Reagent 1, stopper and leave in centrifugal tube over night. Without disturbing the precipitate centrifugalize till the supernatant liquid is quite clear. Decant the clear supernantant liquid, wash the residue twice with methyl alcohol diluted with an equal volume of water, and in the combined liquids thus obtained determine the nitrogen as under Total Nitrogen (No. 10).

Calculation:

The nitrogen found is the amount of non-protein nitrogen.

15. Remaining protein Nitrogen

Method:

From the nitrogen of demucinized saliva obtained in No. 13 subtract the non-protein nitrogen obtained in No. 14. The difference is protein nitrogen less mucin nitrogen.

16. Chlorides

Method:

An application of the Volhard-Harvey method as adapted by Myers and Short (3) to the determination of chlorides in blood. Proteins are precipitated by saturation with picric acid, removed by centrifugalizing; an excess of standard silver nitrate-acidified ferric alum indicator solution added, the silver chloride removed by centrifugalizing; then the unused silver in the supernatant fluid determined by titration with standard ammonium thiocyanate. From the amount of silver used the quantity of chloride is estimated.

Reagents:

1. Saturated solution of picric acid (chloride-free).

2. Standard silver nitrate-acidified ferric alum indicator solution. Exactly

0.726 gm. pure silver nitrate is dissolved in about 300 cc. distilled water in a graduated liter flask; in a separate container 25 gms. of crystalline ferric ammonium sulfate are dissolved in about 300 cc. of distilled water, 25 cc. of 25% nitric acid added and the whole transferred (usually filtered) into the flask with the silver nitrate solution. Distilled water is then added to the liter flask to accurately bring the volume to 1 liter. 1 cc. of this solution is equivalent to 0.25 mg. NaCl.

3. Standard ammonium thiocyanate solution. This contains approximately 0.65 gm. of the thiocyanate to 1000 cc. It may be made a little stronger, standardized against Reagent 2 and reduced to exactly double the equivalent strength; or, if preferred, it may be retained at the strength found on the first titration and a factor employed for obtaining the exact double equivalent of Reagent 2 for each amount used. In titration the endpoint is the first appearance of a permanent reddish-brown which extends throughout the mixture.

Procedure:

To 2 cc. centrifugalized saliva, accurately measured into a centrifugal tube, add 20 mgs. powdered picric acid and agitate thoroughly. Add 8 cc. accurately measured Reagent 1 and centrifugalize the well-mixed contents. To 5 cc. of the clear supernatant liquid, accurately measured into a dry centrifugal tube of at least 25 cc. capacity, add 20 cc. accurately measured Reagent 2, mix thoroughly and separate the precipitated silver chloride by centrifugalization. By means of a 20 cc. pipette transfer 20 cc. of the clear supernatant liquid to a porcelain dish of suitable size and titrate with Reagent 3.

Calculation:

(1) 20 — (titer $\times$ 5/2) $\times$ 25 = mgs. chloride as NaCl per 100 cc. saliva.

(2) $\dfrac{\text{Mgs. NaCl per 100 cc.} \times \text{vol. in 20 minutes}}{100}$ = mgs. chloride as NaCl in 20 minutes.

17. Thiocyanates

Method:

Thiocyanates are converted into ferric thiocyanate by the addition of ferric chloride acidified with hydrochloric acid, and are then estimated colorimetrically. Findings are in terms of ammonium thiocyanate.

Reagents:

1. 5% ferric chloride solution.
2. 0.1 N hydrochloride acid solution.
3. Standard ammonium thiocyanate solution. Dissolve 0.5 gm. of the dry, chemically pure salt in distilled water and bring the volume to 1000 cc. 1 cc. of this solution then contains 0.5 mg. ammonium thiocyanate.

Procedure:

To 2 cc. saliva delivered from an Ostwald pipette into a 10 cc. cylinder are added 0.5 cc. Reagent 2 followed by 0.5 cc. Reagent 1. The contents are then brought up to 10 cc. with distilled water and thoroughly mixed.

To 1 cc. Reagent 3 in a graduated cylinder are likewise added, at approximately the same time, 0.5 cc. Reagent 2 followed by 0.5 cc. Reagent 1. The contents are then diluted to from 10 to 20 cc. (or beyond) with distilled water, to match the color of the unknown.

The comparison of the unknown solution with the standard is then made in a colorimeter (Bock-Benedict, Dubosc\[illegible\] or Kober) in the usual way.

Calculation:

S = reading of standard.
R = reading of unknown found by comparison.
D = dilution of unknown (10).
D′ = dilution of standard.

(1) $\dfrac{S \times D}{R \times D'} \times 25$ = mgs. thiocyanate as NH_4CNS per 100 cc. saliva.

(2) $\frac{\text{mgs. thiocyanate per 100 cc.} \times \text{vol. in 20 minutes}}{100}$ = mgs. thiocyanate as NH_4CNS in 20 minutes.

18. Sodium

Method:

This, together with the determinations of potassium and calcium, is an adaptation of the methods of Kramer and Tisdall (4) for the corresponding determinations in blood. From a hydrochloric acid solution of the ash of the saliva sodium is precipitated as the pyroantimoniate and estimated gravimetrically; potassium as the cobalti-nitrite and estimated volumetrically; and calcium as the oxalate and estimated volumetrically. Blanks on the reagents of the respective determinations should be made.

Reagents:

1. 0.1 N hydrochloric acid solution.
2. Phenolsulfonephthalein (phenol red) solution. To 0.1 gm. phenolsulfonephthalein add 5.7 cc. 0.05 N NaOH, triturate in an agate mortar, and add distilled water to 25 cc. for stock solution (0.4%). For use dilute to 0.02%; e.g., 5 cc. to 100 cc.
3. Potassium hydroxide, Na-free, alcohol-washed. 10% solution, kept in a paraffined bottle.
4. Potassium pyroantimoniate reagent. 500 cc. distilled water are heated to boiling in a Pyrex flask and approximately 10 gms. "potassium antimonate (J. T. Baker)" are added. The boiling is continued from three to five minutes and the flask immediately cooled under running water; when the contents are cold, 15 cc. Reagent 3 are added. The solution is then filtered through ash-free filter paper into a paraffined bottle. Some of the undissolved potassium pyroantimoniate will pass through even the best filter paper. If the reagent is allowed to stand 24 hours after filtering, all the undissolved potassium pyroantimoniate will settle to the bottom, leaving a clear supernatant fluid that may be used as long as it remains so. It keeps perfectly well at room temperature for at least one month. 10 cc. will precipitate 11 mgs. sodium.
5. 95% alcohol. Redistilled.
6. 30% alcohol.

Procedure:

(a) Preparation of the saliva. To the ash of 8 cc. saliva (No. 9) Reagent 1 is added with gentle warming to assure solution and the whole quantitatively transferred to a 10 cc. volumetric flask and made up to volume, when cool, with the reagent. Any slight carbon particles may be removed by centrifugalization or decantation (Solution A).

(b) Determination of sodium. This is carried out on 4 cc. of Solution A as described in the technic by Kramer and Tisdall (4). Platinum dishes for the collection of the precipitate need not be employed.[7]

Calculation:

(1) $\frac{\frac{\text{gms. precipitate}}{11.06} - \text{blank on reagents} \times 100}{\text{no. cc. original saliva used in the 4 cc. taken}}$ = gms. Na per 100 cc. saliva.

(2) $\frac{\text{gms. Na per 100 cc.} \times \text{vol. in 20 minutes}}{100}$ = gms. Na in 20 minutes.

19. Potassium

Reagents:

1. Sodium nitrite solution. Dissolve 15 gms. K-free sodium nitrite (Merck) in 30 cc. distilled water.
2. Sodium cobalti-nitrite reagent. Solution a: 25 gms. cobalt nitrate crystals (J. T. Baker) are dissolved in 50 cc. distilled water and to this solution are added 12.5 cc. glacial acetic acid. Solution b: 120 gms. K-free sodium nitrite (Merck) are dissolved in 180 cc. distilled water, giving a total volume of

[7] *Jour. Biol. Chem.*, 1922, L, 301.

about 220 cc. To all of Solution a, are added 210 cc. of Solution b. Nitric oxide gas is formed. Air is drawn through the solution until gas has passed off. The reagent is placed in the ice chest; filtered each time used. It keeps one month.

3. 0.02 N potassium permanganate. This solution is standardized against Reagent 4.

4. 0.01 N sodium oxalate. Dissolve 6.7 gms. sodium oxalate in 1000 cc. distilled water with the aid of 5 cc. concentrated sulfuric acid. Dilute ten times for use.

5. Approximately 4 N sulfuric acid. 20 cc. concentrated sulfuric acid (C. P.) are diluted to 100 cc. with distilled water.

Procedure:

0.2 cc. of No. 18, Solution A is employed. The procedure is carried out as described in the technic by Kramer and Tisdall.

Calculation:

(1) Total no. cc. Reagent 3 used — 0.03 cc. (permanganate blank) × 2 — no. cc. Reagent 4 used — blank on reagents ×

$$\frac{0.0071}{0.02 \times \text{no. cc. original saliva used}} = \text{gms. K per 100 cc. saliva.}$$

(2) Gms. K per 100 cc. × vol. in 20 minutes

$$\frac{}{100} = \text{gms. K in 20 minutes.}$$

20. Calcium

Reagents:

1. Ammonium oxalate, C. P. Saturated solution.

2. Sodium acetate, Ca-free. Filtered saturated solution. Add an excess of the salt to distilled water and let stand over night. Filter the supernatant fluid.

3. 0.01 N potassium permanganate. Standardized against No. 19, Reagent 4.

4. Approximately N sulfuric acid. 50 cc. concentrated sulfuric acid (C. P.) are diluted to 1000 cc. with distilled water.

5. Ammonia solution. 2 cc. concentrated ammonia are diluted to 100 cc. with distilled water.

Procedure:

4 cc. of No. 18, Solution A are employed. The procedure is carried out as described in the technic by Kramer and Tisdall.

Calculation:

(1) No. cc. Reagent 3 used — 0.03 cc. (permanganate blank) — blank on reagents ×

$$\frac{0.02}{\text{no. cc. original saliva in the 4 cc. taken}} = \text{gms. Ca per 100 cc. saliva.}$$

(2) Gms. Ca per 100 cc. × vol. in 20 minutes

$$\frac{}{100} = \text{gms. Ca in 20 minutes.}$$

Bibliography

1. Henderson, Yandell and Morriss, W. H. The Determination of CO_2 in Alveolar Air and Blood, and the CO_2 Combining Power of Plasma, and of Whole Blood. *Jour. Biol. Chem.*, 1917, xxxi, 217.

2. Cole, Sydney W. Practical Physiological Chemistry. Fifth edition. Cambridge University Press, 1919.

3. Myers, Victor Caryl. Practical Chemical Analysis of Blood. St. Louis, C. V. Mosby Co., 1921.

4. Kramer, Benjamin and Tisdall, Frederick F. The Direct Quantitative Determination of Sodium, Potassium, Calcium and Magnesium in small amounts of Blood. *Jour. Biol. Chem.*, 1921, xlviii, 223.

5. Gies, William J. and Kahn, Max. An Inquiry into the Possible Relation of Sulfocyanate to Dental Caries. *Dental Cosmos*, 1913, LV, 40.

6. Autenrieth, W. and Funk, Albert. The Determination of Thiocyanate in the Saliva and of Iodin in the Urine. *Muench med. Wochschr.*, 59,2657-60,2736-9.

7. Ferris, Henry C. The Human Saliva as an Index of Oral and Constitutional Pathological Conditions. *Dental Cosmos*, 1921, lxiii, 1093.

8. United States Pharmacopoeia, IX.

9. Clark, W. Mansfield. The Determination of Hydrogen ions. Baltimore, Williams & Wilkins Co., 1920.

DENTAL EDUCATION IN JAPAN

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(Read before the National Association of Dental Faculties)

THERE are ten dental schools throughout Japan and these school may be placed in the following three classes:

(*A*) *Those schools which have college rank and are designated by the Minister of Education.*

The college or "Semmon Gakko" in Japan means those schools which admit only those who have completed the five-year middle school, or four year girls' high school course, or those who have equal standing in learning, after having completed the six-year elementary school course, and which are, in addition, recognized by the Minister of Education. As the applicants for admission usually exceed the number prescribed they have to take a competitive entrance examination for admittance to any of the colleges. Of these colleges the following three are designated by the Minister of Education, as is provided in the first clause of Article I of the Dental Law, and their graduates have the privilege of practicing dentistry without examination while they are allowed to use the degree of Shikwa-Igakushi (Doctor of Dental Science) capped with the name of the alma mater.

The basis on which the Minister of Education bestows the above privilege on the graduates, is provided for by an ordinance of the Department of Education, promulgated in 1906. In this respect, Article II of the Ordinance, designating the following seven conditions, provides that those colleges which are recognized by the Minister of Education as satisfactory in the work of the students and graduates, in up-keep, and in the management of the college, are only eligible.

(1) Equipment of proper lecture room, library, specimen room, chemicals room, instrument room, laboratory room, and the necessary accommodation for the number of students prescribed.

(2) Qualification required for applicants for admission should be that they have completed the middle school or four-year girls' high school course, or that they are certified as equal to what is required by the rules of the official qualification examination for admission to the college.

(3) The following subjects are compulsorily assigned and the course of study must be at least for three years: Anatomy, physiology, general pathology and diagnostics, materia medica, bacteriology, general surgery and dentistry.

(4) The following subjects of dentistry are compulsory: Dental pathology, oral surgery with clinical lectures, operative dentistry with practice and clinical lectures, prosthetic dentistry with practice, and orthodontics with clinical lectures.

(5) The engagement of at least three teachers for dentistry and at least one teacher for each subject mentioned in (3) and these teachers must be properly quali-

fied in conformity with the regulation provided.

(6) That the college has been carried on for at least two years since its establishment.

(7) The number of out-patients for students' practice must be more than twenty a day for a school that has less than fifty students on an average in each class. For every ten additional students there must be four additional out-patients.

Tokyo Dental College (Tokyo) was recognized in 1907 and designated in 1910 by the Minister of Education, privileges thus bestowed taking effect in 1911. Four-year course. President: Dr. Morinosuke Chiwaki. Attached to this college there is a preparatory class for examination for those candidates who are to take the government dental examination under the old system.

Nippon Dental College (Tokyo) was recognized in 1909 and designated in 1910 by the Minister of Education taking effect in 1912. Four-year course.

Osaka Dental College (Osaka) was recognized in 1916 and designated in 1920, taking effect in 1920. Three-and-half-year course.

(*B*) *Those which have college rank but are not yet designated by the Minister of Education.*

The following two colleges belong to this class and their graduates are also allowed to use the degree as in the case of (A).

Toyo Dental College (Tokyo) was recognized in 1920 by the Minister of Education. Four-year course. This college has the same preparatory class as the Tokyo Dental College.

Kyushu Dental College (Fukuoka) was recognized in 1921. Three-year course.

(*C*) *Those schools which do not rank as colleges:*

The schools which belong to this class are for those candidates who are to undergo the government dental examination.

Aichi Dental School (Nagoya), established in 1894.

Kyoto Dental School (Kyoto), established in 1905.

Hiroshima Dental School (Hiroshima), established in 1912.

Tokyo Girls' Dental School (Tokyo), established in 1910.

Meikwa Girl's Dental School (Tokyo), established in 1917.

Some of the above schools which are all of three-year course, have applied for recognition as colleges to the authorities and their recognition is expected before long. The first three schools admit those who have completed the middle school course, or who are certified as equal in learning, while the latter two admit only those who have completed the girls' high school course.

Dental Instruction for Medical Students

The dental instruction is given to the students of the following medical school as under:

(1) The Department of Medicine, Tokyo Imperial University. In the fourth year the following lectures in dentistry are given to the students: One hour a week, clinical lectures; two hours a week, clinical lectures on out-patients; twelve hours a week.

(2) The Department of Medicine, Keio University. As this department was lately established the educational system of dentistry is not yet fixed. At present it has a section attached to the hospital of the department and it is training some nurses as dental nurses.

(3) Chiba Medical College. In this college, dentistry and oral surgery are included in the course of surgery. In the third and fourth year a lecture is given to the students one hour a week, clinical lectures two hours a week for the third year and clinical lectures on out-patients three times a week for the fourth year.

(4) Kyoto Medical College. Lectures are given an hour a week to the third year class and a one hour clinical lecture to the fourth year class and also clinical lectures on out-patients are given every day.

(5) Aichi Medical College. In the fourth year the following lectures are given under the guidance of Professor Ichiro Kitamura: One hour a week, clinical lectures on out-patients; ten hours a week.

The Tokyo Dental College, founded in 1900, is the oldest institution of its kind in Japan. The Takayama Dental College, from which the Tokyo Dental College originated, was founded in January, 1890, by Dr. Kisai Takayama, when modern dentistry in our country had only begun. Some idea of the scope of its work and activity may be obtained from the fact that there have been 3,769 graduates, which comprise about sixty per cent of the total number of dentists throughout Japan.

The staff of the college has been active in research and the results are published from time to time in the monthly journal, *Shikwa Gakuho,* issued by the school during the past twenty-six years. The college has also undertaken to compile all necessary text-books in the Japanese language and the number of such publications amounts to 158 volumes.

Through successive extension and development the Tokyo Dental College was recognized in 1907 by the government as equivalent to other professional schools (medical) maintained by the government and its graduates were authorized in 1911 to practice dentistry without a special examination.

The present standards of education, as adopted by the Tokyo Dental College are as folows: Candidates for admission must be those who have finished a middle school, five-year course, and as candidates annually exceed the number prescribed, they are selected by a competitive examination in Japanese, English, physics, and chemistry, and also by a physical examination. The middle school course is comparable to that of a high school in the United States. Those desiring to matriculate in the higher classes are required to pass an examination in the subjects completed by those classes.

Chinese, Korean and Formosan applicants who do not fulfill the above rules concerning requirements are admitted as special students. This class of graduates enjoy the privilege of practicing in their countries without an examination. There were five such graduates.

Arrangement of Session

At first the course of instruction covered three years; later it was extended to three years and a half, and in 1919, to four years, which plan is maintained up to date. Each academic year commences on April 1 and closes on March 31 of the following year. It is divided into two terms, and the actual instruction given in each year consists of thirty-four weeks. The subjects and hours given to each class are shown in the following table.

SUBJECTS		1st year		2nd year		3rd year		4th year	
		I T.	II T.	I T.	II T.	I T.	II T.	I T.	II T.
Ethics		1	1	1	1	1	1		
English		4	4	2	2	4	4		
German		2	2						
Physics	Lect. and Demonst.	3							
Chemistry	Lect. and Lab.	4	6						

SUBJECTS	1st year I T.	1st year II T.	2nd year I T.	2nd year II T.	3rd year I T.	3rd year II T.	4th year I T.	4th year II T.
Anatomy — Systemic Anat., Lect.	5	4						
Anatomy — Dissection	3	3						
Anatomy — Dental Anat., Lect. and Lab.	2	2						
Anatomy — Histology, Lect.	2							
Anatomy — Dental Hist., Lect.	2							
Anatomy — Histology, Lab.		3						
Anatomy — Embryology, Lect.		2						
Phsyiology and Medical Chem. — Lect. and Demonst.	6	6						
Bacteriology — Lect.			2	2				
Bacteriology — Lab.					2			
Hygiene — General and Oral.							2	2
Pathology — General Phatho., Lect.			2	2				
Pathology — Dental Patho., Lect.			2	2				
Pathology — Patho.-Histology, Lab.					2			
Materia Medica — Lect.			2	2				
Materia Medica — Pharmaceutics, Lab.					*			
Materials and Metallurgy — Lect. and Demonst.			2					
Operative Dentistry — Therapeutics, Lect.				2	2			
Operative Dentistry — Therapeutics Clinical Lect.					2	2		
Operative Dentistry — Fillings and Inlays, Lect.			2	2				
Operative Dentistry — Operative Technic				4	8			
Surgery — General Surgery, Lect.				2				
Surgery — Oral Surgery, Lect.					2	2		
Surgery — Oral Clinical Lect. and Practice.					2	2		
Internal Medicine — Lect. and Clinical Lect.						2	2	
Internal Medicine — Diagnostics, Lect. and Practice.						3		
Roentgenology — Lect. and Lab.						1		
Prosthetic Dentistry — Lect.			3	2				
Prosthetic Dentistry — Lab.		3	8	8	4			
Prosthetic Dentistry — Crown and Bridge-work, Lect.			3					
Prosthetic Dentistry — Crown Lab.			4	4				
Prosthetic Dentistry — Clinical Lect.						2	2	
Orthodontics — Lect.					2	2		
Orthodontics — Clinical Lect. and Lab.					2	3		
Dental Jurisprudence							1	1
Clinical Practice					3	12	30	30
Special Lecture — Dental History								
Special Lecture — Economics, Literature, etc.							2	2
Total hours	34	36	33	35	36	35	39	35

* Indefinite.

Students and Teachers

The number of students in April, 1922, was 550 with 7 special students. The students form an association called the Students' Association, the chief object of which is to promote friendship and fraternity among its members.

There are in all 64 teachers, the greater part of whom do not practice, but stay all day in the College, devoting themselves to research, to lecturing and practical instruction. The classification of teachers is as follows:

	Professors	Assistant Professors	Lecturers	Instructors	Assistants	Total
Full time Teachers	10	6		17	8	41
Part time Teachers	11		8	4		23
Total	21	6	8	21	8	64

Examinations and Graduation

At the end of each term examinations are held and those who fail in them are not promoted to higher classes. Promotion also is refused to those whose absence exceeds one-third of the tuition hours and to those who have not completed the practical work assigned. Furthermore, both at the close of the second year and of the fourth year, a graduation examination is held in the following subjects: Anatomy, pathology, operative dentistry, prosthetic dentistry, physiology, materia medica, surgery, and orthodontics.

Infirmary

The infirmary, whose object it is to give facilities to the clinical practice of the students, treats out-patients every day from 10 A. M. to 5 P. M. (In summer from 8 A. M. to noon.) A large number of patients daily visiting the infirmary affords the students ample opportunity for practice. New patients in 1920 were 5,918 in all, and the actual number of treatments during the year was 43,972 so that the average number coming for daily treatment was 139.6. The infirmary consists of Preliminary Diagnosis Department, Minor Surgery Department, Therapeutic Department, Filling and Inlay Department, Oral Surgery Department, Orthodontic Department, Children's Department, Plate Work Department, Crown and Bridge-Work Department, Department of Radiography, Supply Department, and Dispensary. Each department is in charge of a full-time professor or an assistant professor, and two or three other instructors who all help the students in practical work.

Supplementary Instruction

The post-graduate course is provided for those graduates who desire to pursue further studies of special subjects at the college. The course may be for one or two years. The students are made to study under the guidance of professors in charge.

Since 1917 the college has annually held a summer course for practitioners who desire supplementary clinical lectures. For each session 20 students are admitted, and the subjects taught are oral surgery, prosthetic dentistry, crown and bridge-work, orthodontics, roentgenology, inlay and porcelain work.

Furthermore, since October, 1920, lectures on special subjects have been given for those dentists practicing in Tokyo and its vicinty who wish to utilize their spare hours. Two classes for prosthetic dentistry and oral surgery, respectively, and one class for orthodontics and inlays are conducted. The number of each class is always limited to ten, and 12 to 18 clinical lectures and demonstrations are given. Facilities for researches in chemistry, anatomy, histology, pathology, bacteriology, and radiography are provided for those who desire to carry out some special studies.

THE OMAHA FREE DENTAL DISPENSARY FOR CHILDREN

By EDWARD H. BRUENING, D.D.S., Omaha, Nebraska

AFTER the first two school nurses employed by the Omaha Board of Education had made a number of inspections in the schools, they applied to Creighton Dental College for help. They described the mouth conditions as very bad and something had to be done. The college authorities arranged a special clinic for Saturday mornings, volunteer operators and advanced senior students doing the work. Soon more nurses were employed and the clinic grew until a hundred were treated one morning. The demand for this service had outgrown the capacity of the college.

These facts were brought to the attention of the members of two local dental societies. A committee was appointed from each and, with the organization of this joint committee, the Omaha Free Dental Dispensary for children was started. The plans of other cities were studied but there was always something in them that did not fit our conditions. We visited the Forsythe Institute in Boston and several other clinics and infirmaries, getting information as to the experience of others, but still we felt that we needed something a little different.

We wanted a centrally located infirmary with five operating chairs, fitted with the best equipment the manufacturers could furnish. We also wanted one full-time operator, a secretary and two lady assistants, 100 dentists who would sign an agreement to give a half day a month for this work, in the dispensary, for a period of three years.

After making a quiet campaign, we secured a donation of very desirable space in one of our large office buildings; also a considerable amount of small supplies from the various dealers and manufacturers. A carefully made up budget showed us that we needed about $5,000 to pay for the equipment and to take care of our salary list for one year. Maintenance costs for materials and laundry were very light. This money was obtained in a campaign of personal solicitation by the dentists, several clubs, nurses and a number of physicians.

The management was vested in a board of fifteen members, nine dentists and six laymen. The personnel of this board remained unchanged until the dispensary was turned over to the city. The laymen were prominent in their various lines of business but did not take an active part in the management of the institution. This was in the hands of five dentists who met in the infirmary every week to go over the records, buy supplies, pass on cases where illegibility was in question and supervise the work of employees.

The nurses of the department of health supervision of the Board of Education worked in close harmony with this institution under the very able direction of Miss Charlotte Townsend, to whom we owe a great deal of credit for her earnest work, in behalf of the poor children of Omaha.

Only the cases recommended by these nurses were received and these recommendations were only given after a careful examination of the home conditions had been made. We required a statement

as to the family income, a signed permission from the parent or guardian for the child to receive treatment and that anesthetics could be used if deemed necessary. Fourteen years was the age limit for two years, then it was raised to fifteen. No adults were treated.

We had no trouble in securing the signatures of 80 of our local dentists offering to give one-half day a month to this work and they were very faithful in keeping their appointments because they were interested. It was the grandest charitable act they could do. Nobody but a dentist *could* do it. A careful record of each man's work was kept and the number of hours he spent in the clinic. This, however was never published.

We took advantage of every opportunity to let the public know what was being done in our dispensary. The newspapers were very kind in frequently giving us space. Nearly every dentist in the city had a neatly framed card hung in a conspicuous place in his office, calling the attention of his patients to this institution and inviting them to ask questons about it; but it was the work of Mr. Warren, of the Warren Film Company, of Omaha, that did the big things in advertising our work. He became seriously interested in doing something to help the children and he, with some assistance, wrote a scenario that told the story better than could be done in any other way. A bit of romance was woven into it, a bit of patriotism, and the really big idea which was the organization methods used in the infirmary and the benefits derived from the treatment. This story was interesting to everyone who saw the picture, the film being produced in Omaha. We called upon any person or organization we needed and all gladly consented to act before the camera for this purpose. The result was very satisfactory. It required about 20 minutes to run this film and it was shown in every picture theatre in our city.

Soon after the showing of the film, we asked 300 ladies to assist us in a "Tag Day" campaign. They did, gladly, even though the temperature on that day was 13 degres below zero. We raised $5,000, enough to carry us the balance of the second year and through the third. We had about $500 left when we turned our institution over to the Omaha Board of Education as a gift to the city of Omaha. It is now, however, in the city hall and doing most efficient service under the supervisor of the health department.

The outstanding fact is that anyone can do as much for his city if he will form an organization and go to work with a will. He will find that nearly everyone is ready to help in this work as soon as they understand its importance. There is nothing dental men can do that will give them as much personal satisfaction as to arrange for the prevention of mouth infection in our future citizens. Let "prevention of disease" be our slogan.

PERMEABILITY OF THE ENAMEL IN RELATION TO STAINS[1]

By CHARLES F. BODECKER, D.D.S., Berlin, Germany

(Read before the American Dental Association, Los Angeles, California, July 17-21, 1922)

MOST histologists have not considered the enamel of the human teeth to be unstainable and impermeable, but regarded it as being purely inorganic. Recent investigations of capable men have, however, produced evidence that this theory is no longer tenable.

Many clinicians regard this controversy with indifference, for it does not seem to them important for their work whether the enamel contains organic matter, is stainable or not, or can be penetrated by fluids under certain conditions. And yet, even for the clinician, it is of significance, for the condition of the enamel stands in close relationship to the condition of the pulp. Upon death of the pulp, whatever nutrient circulation may take place in the hard tissues, ceases. Under such conditions, the enamel, as proven by clinical evidence, undergoes a structural change.

Another practical point affected by the decision of the above controversy is the question of the subsequent calcification of the enamel after the eruption of the tooth. The clinically recognized fact that enamel, in the course of time, becomes harder, is due to the continued deposition of calcium salts in that tissue. Briefly outlined, the process that takes place is the following: The enamel organ determines the form and extent of the tissue, while the ameloblasts are responsible for the calcification. However, as a subsequent increase of calcium salts occurs, the deposition of salts by the ameloblasts may be termed the *primary calcification*. The term *secondary calcification* would include whatever deposition of salts takes place after the ameloblasts had performed their function. Whether the secondary calcification of the enamel depends upon a deposition of salts from the surface inward, or whether this hardening depends upon internal circulation in connection with the pulp, are questions which have not as yet, been definitely decided. If either of these theories is proved, it may be hoped that the clinician will be in a position to affect the condition of the teeth and make them more resistant to caries by prescribing proper medication.

The author has, since 1905, taken the standpoint that the human adult enamel contains a greater amount of organic matter than that given in most chemical analyses, and that this organic matter is in connection with the pulp through the odontoblastic tubes of the dentin. He arrived at this conclusion. 1. By special methods of decalcification; 2. By the use of ultra-violet light for the production of the photomicrographs; 3. By special methods of staining. J. Leon Williams honored me by examining my specimens in the fall of 1921 and provisionally accepted my theory concerning

[1](Research work performed by the aid of the fund of the Rudolf H. Hofheinz Research Department, Rochester Dental Dispensary.)

the presence of organic matter in the enamel.

The permeability of the enamel to solutions of different osmotic tension has been conclusively proven by the excellent work of R. W. Bunting, which I have corroborated. This is undoubtedly a step in the right direction, for we do not think of the enamel any more as an impervious covering of the cusps of the teeth, but as a permeable membrane. In repeating the experiments of Bunting, the author has substituted different stains, in order to attempt to show the channels by which fluids may pass from

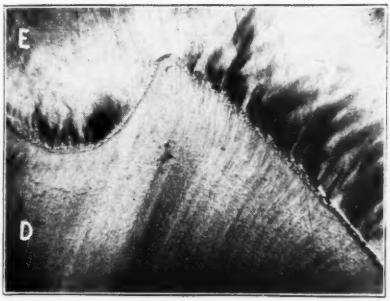


Fig. 1.—Longitudinal section of human molar. The tooth injected from apical foramen with safranin. Coloring agent passed through the pulp chamber and dentinal tubules into the enamel, staining the organic matter red (seen as black). E, enamel; D, dentin. (30X)

the pulp chamber to the surface of the enamel. The results, are, however, not yet ripe for publication.

My first attempts at staining the enamel by way of the pulp chamber, were undertaken in 1912 in following up the work of von Beust. This investigator cemented the needle of a hypodermic syringe into the enlarged apical foramen of a tooth and forced stains through pulp chamber and dentinal canals into the enamel. I repeated these experiments with varying success. There can be no doubt in my mind but that there are several unknown factors connected with this question which cause such varying results. This is proven by the fact that Bunting was successful in passing a saline solution through the entire thickness of the crown of a tooth into the surrounding media in a short time and Pickerill was not able to penetrate the enamel with a stain, in repeating von Beust's experiments.

The possibility of staining human adult enamel by any method, has often been denied by some of the most eminent investigators, yet others and the author have been repeatedly successful. This is proven by the first two photomicrographs in which the dark areas represent enamel stained a bright red in the specimen.

Before continuing, I wish to explain the action of stains in differentiating between tissues. The metallic stains, silver and gold, can not be regarded as true stains, for they are precipitated in the tissues in minute particles. This is especially the case when intercellular spaces or clefts abound in the specimen. Carmine, in different combinations, also acts in the same manner. Therefore, when my father, in the eighties, demonstrated organic matter in the enamel of the human teeth by means of chloride of gold, it was not regarded as proof positive of its presence. The use of the anilin dyes, however, which act differently, furnishes a more reliable proof of the presence of organic matter.

The author has repeatedly emphasized the fact that the organic matter of the enamel can be stained, a view now supported by many histologists. A number, however, still doubt this possibility, and for that reason two photomicrographs are shown.

Figure 1 depicts a human molar, under an enlargement of 30 diameters, stained with the anilin dye, safranin. We clearly see darkly stained structures, passing into the enamel from the surface of the dentin. Their fan-like form is due to the divergent course of the enamel prisms.

Figure 2 is an enlargement of 150 diameters of the same specimen. The interprismatic substance takes the coloring agent more readily, but at some places of the photomicrograph, even the body of the enamel prisms are stained, proving them to contain organic matter.

It has long been my conviction that the interprismatic substance of the enamel is a more important structure than believed. Its very existence is doubted by a few investigators and those

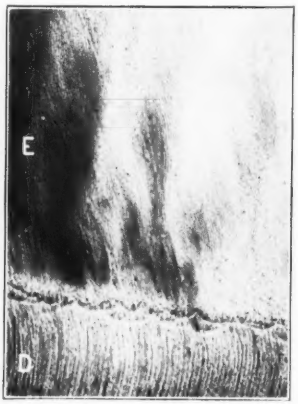


Fig. 2.—Same as Figure 1, enlarged 150 X. The dark areas in the enamel, stained with safranin by injection. E, enamel; D, dentin.

who do admit its presence, credit it with the function of only imbedding the enamel prisms. The author, however, believes this structure to have the function of distributing the nutrient fluid in the enamel. Naturally, this activity is greatest during youth and grows less and less with age. The designation, interprismatic substance of the enamel, does not give a clear idea of this structure. As I have shown elsewhere, each prism is enveloped with its individual sheath, and therefore I consider the enamel prism sheath a more exact appellation.

If the theory that the enamel prism sheath represents the circulatory channels in the enamel is correct, it ought to be possible to demonstrate their connection with the pulp by way of the dentinal tubules. In the human enamel, this has, up to the present, not been possible. However, this does not absolutely prove that such channels do not exist. Many structures, originally discovered in animals, have only been subsequently demonstrated in the human tissues. The complicated phenomena of karyokinesis (indirect cell division) for instance, would never have been unravelled in man, unless histologists had discovered this phenomena in its simplest form in Ascaris (intestinal worm of the horse). In the same manner, my brother and I were able to demonstrate the minute structure of the tubular process of the odontoblast (Tomes fibre) as well as the tubular anastomoses, only upon the basis of the observations made in examining sheep's dentin. In man, whether through development or degeneration, many structures have changed almost beyond recognition. To interpret their significance, the only method which promises results is to study these same structures in their simplest forms in the lower animals. To my mind, many mooted questions of dental research can, and will only be settled, when the study of the teeth of animals becomes more general.

For this reason, the author performed injection experiments with teeth of different animals and achieved excellent results; an anilin stain penetrating far into the enamel. It was especially gratifying to discover that the interprismatic substance of the enamel was, at most places, connected with the dentinal tubules.

A detailed description of the technic used will be published when all experiments are concluded, and a decision as to the most efficient method reached. For the present, it will suffice to say that four methods were used:

1. Simple absorption, by placing only the end of the root of the tooth in the stain;

2. Pressure brought to bear upon

the stain in the pulp chamber by a hypodermic syringe or a column of mercury;

3. Atmospheric pressure, by placing the crown of the tooth in a partially evacuated jar and the stain in the canal;

4. By osmosis.

The following photomicrographs show that the enamel is permeable for safranin. Figure 3 illustrates a low enlargement of a longitudinal section of a calf's incisor. The tooth was injected from the pulp chamber with safranin,

Fig. 3.—Longitudinal section of a calf's incisor. The tooth injected from apical foramin with safranin, which passed through dentin into enamel, shown as dark clouds. E, enamel; D, dentin. (30X)

the stain has penetrated the dentin as well as a third to a half of the enamel.

Figure 4, a higher enlargement of the same specimen, shows the dento-enamel junction, with many of the dentinal tubules crossing into the enamel and joining with the enamel prism sheaths. Each sheath, crossing the light narrow zone between dentin and enamel, has its connection with a dentinal tubule, although this is not as apparent in the photomicrograph as I could wish. These connections can, of course, be much more clearly demonstrated by subjective examination of the specimen, as the slide can be examined in its entire depth. The marked coloring, which is striking, also adds much to the clearness; on the photomicrograph both of these factors are missing.

In man, we frequently see the dentinal tubules crossing the boundary into the enamel and ending in the so-called protoplasmic bodies of different shape. These, however, rarely follow the course of the enamel prisms, but run obliquely across them for a short distance. In this photomicrograph of calf's enamel, there are only two dentinal canals which follow this oblique course, the remaining ones following the direction of the

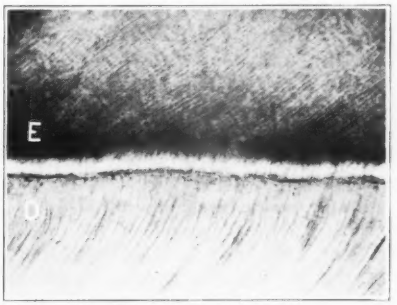


Fig. 4.—Same as Figure 3, enlarged 310 X Showing that the stain has passed through the tubules of the dentin into the enamel prism sheaths. E, enamel; D, dentin.

prisms, join with the sheaths and have the same texture and coloring as these. Upon this I base my assertion, that whatever nutrient fluid passes through the dentinal tubules, which are in connection with prism sheaths, must penetrate the enamel. Though the case in point is a calf's tooth, the same is probably true also in the human enamel. How late in life this circulation in the enamel is maintained, further investigation will show.

In conclusion the author claims that the interprismatic substance or enamel prism sheaths represent nutrient channels in the enamel and are in direct connection with the dentinal tubules as proved by his specimens.

PREPARATION OF THE MOUTH FOR THE PROSTHETIST FROM THE SURGICAL STANDPOINT

By BOYD S. GARDNER, D.D.S., Rochester, Minnesota

(Read before the American Dental Association, Los Angeles, California, July 17-21, 1922)

DURING the past few years methods of extracting teeth other than common pulling have attracted the attention of members of the dental and medical professions. No doubt the pioneer work of Novitsky, Shearer, Lucas, and many others was done primarily to eliminate associated pathologic conditions at the time of extraction. Since this work, important considerations have resulted in the working out of an operation less radical yet just as efficient termed "alveolotomy." By this method trauma and shock are reduced to the minimum and teeth and roots with their associated pathologic conditions are removed in their entirety. When teeth are to remain, it is possible to leave the process surrounding them undisturbed; with the older methods, this was not often the case. It is obvious that only the roentgen ray made this progress possible. Following the extraction of teeth the operator's next consideration is the preparation of the mouth for the prosthetist. It is my purpose here to deal with this phase of our work.

Although the full mouth picture is a necessity and of greatest aid to the operator, a more accurate diagnosis can be made of the conditions present after the soft tissues are retracted, as this enables the operator carefully to examine the buccal and labial aspects of the jaws. The varied pathologic conditions naturally cause a variation in technic and results, for it should be the aim of every operator to eliminate as much as possible of the disease condition with a minimal loss of process. It has been our experience, when at least a part of the process is removed prior to extraction, the teeth are removed with greater ease; hence, shock and trauma are materially reduced. Certain operators are criticized for removing too much of the process, others for not removing enough, so it appears that a misunderstanding regarding the exact technic accounts for the severe criticism of alveolotomy that is often heard. One should have in mind that the thickness of the buccal and labial processes directly covering the roots of teeth varies markedly in different individuals as well as with each tooth of the same individual (Fig. 1). Accordingly, the amount of process removed in the extraction of a given tooth in one patient would vary markedly from that in the extraction of the corresponding tooth in another patient because of a possible anatomical variation. In cases in which teeth are extracted with loss of practically all the process, due to pyorrhea, the results may at times be subject to severe criticism. Thus, without knowledge of the exact condition before operation, one could not possibly be in a position to judge the results after operation. Again, there would be marked variation in the amount of process removed in the correction of the relation of one jaw to the other. In a case of

severe protrusion of the upper jaw, the operator would remove the process on the labial side quite radically and would conserve as much as possible on the lower.

It has been our experience that shock is materially reduced by the use of block anesthesia and the improved chisels. However, the choice of an anesthetic must always be considered to be more or less a personal matter. If the operator feels that he can give his best service

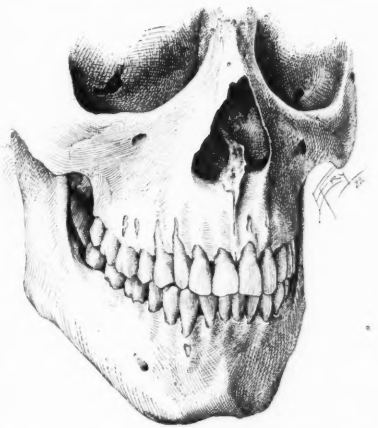


Fig. 1.—Drawing from dry specimen showing loss of process on the labial and buccal aspects.

by the use of a certain anesthetic, he should employ it.

Naturally, asepsis plays an important part in the outcome and unless it is maintained scrupulously, comparative results by different operators are of no value. The conclusions drawn by one operator should not in any way prejudice another, unless all the steps in the technic are exactly the same.

It appears that operators generally agree that it is very important to extract teeth so that no roots are left, and any technic that will make this possible should receive encouragement. Routine postoperative roentgen-ray examinations, have revealed that root tips are rarely left if alveolotomy is used. Eusterman found, in the examination of 283 jaws, from which teeth had been extracted by the older methods, that roots remained in more than 30 per cent; thus, too much emphasis cannot be placed on the importance of a change in technic.

Results of extracting teeth from a patient with diabetes emphasizes the advantage of the improved technic. We have found that there is only a slight increase in sugar in the urine on the following day and that the protein tolerance is markedly raised. Accordingly, such surgical interference from a dental standpoint is not contraindicated in these patients, but care should be exercised as to the number of teeth taken out in one operation; this should be observed in operating on any patient whose resistance is low.

In process reduction, there appears to be two methods for consideration: (1) the elimination of at least part of the process directly labial or buccal to the roots and (2) the removal of process between the roots. Therefore, in the consideration of one or the other method, results should be compared in detail in order to reach a definite conclusion. Blood supply and subsequent regeneration should be carefully considered.

The varied results following process reduction by pressure on the labial or buccal process, to make a green-stick fracture, no doubt, can best be accounted for by the difference in the character of the process. This is emphasized in older patients, in whom the surrounding process becomes very brittle and cannot be manipulated as in younger patients, and when teeth have been pulpless for many years. Another point to be considered in comparing the two methods is ability to extract the tooth without the loss of valuable process (Fig. 2). In the one method in which at least a part of the process is removed before extraction, not only is the tooth removed

in its entirety but the interseptal process is left undisturbed; often by older methods teeth are removed with large pieces of process attached. Teeth with large granulomas, cysts, and so forth, require more radical measures and hence it is impossible always to leave the mouth in a uniform condition.

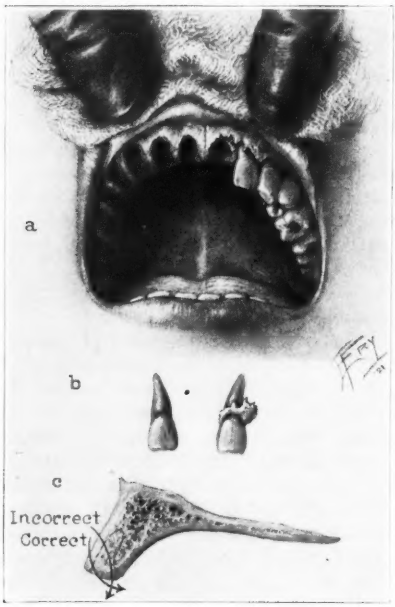


Fig. 2.—(a) Upper right soft tissue contracted and completion of process reduction; upper left shows possible poor results from extraction prior to the removal of the process. (b) Contrasting the two methods. The one is a clean extraction, the other has process attached to the tooth. (c) Correct and incorrect trimming of process following extraction.

The amount of suturing necessary after the surgical preparation of either the maxilla or mandible depends on the soft tissue to be united. More sutures are necessary if there is a deficiency of soft tissue, and they should be removed early if there appears to be too much tension. That valuable process has been sacrificed in attempting to approximate soft tissue, is well recognized and any suture that tends to draw the soft tissue in such a way that it would interfere with a denture is certainly contraindicated. It is not necessary entirely to approximate the soft tissue in order to derive benefit from the suture. Trial sutures, that is, sutures not completely tied until the operator determines whether or not he is causing too much tension are advantageous. The early removal of sutures has been encouraged and the necessity for this can best be determined the second day after operation. Gillis and others have emphasized the necessity of denture construction soon after extraction; the reasons are obvious, and, therefore, consultation with the prosthetist before extraction is very important. Models and facial measurements are often required.

The results of our work for the past year emphasize the use of the chisel technic and less of the rongeur, unless the latter is constructed so that it actually cuts rather than crushes. Files and revolving instruments have been eliminated. Lukens 000 rather than Lukens 00 tanned catgut is used for sutures and the number of sutures used in operating on a full upper jaw is materially reduced.

Bibliography

1. Eusterman, M. F. Report of Roentgenographic and Clinical Findings in the Teeth of Nine Hundred Patients. *Jour. Nat. Dental Assoc.*, March, 1922, p. 257.

2. Gillis, R. R. Preservation Versus Restoration: In Regard to Facial Dimensions and Prosthetic Dentures. Presented before the American Society of Oral Surgeons and Exodontists, Milwaukee, 1921. *Jour. Nat. Dental Assoc.*, April, 1922, p. 295.

3. Lucas, C. Personal communication.

4. Novitsky, J. Dead Teeth. *Dental Summary*, 1919, xxxix, 426-432.

5. Shearer, W. L. External Alveolectomy. *Jour. Nat. Dental Assoc.*, June, 1920, p. 499

THE PRIVATE DENTAL LIBRARY

By HARRIS R. C. WILSON, D.D.S., Cleveland, Ohio

(Read before the American Dental Library and Museum Association, Milwaukee, Wisconsin,

WE MAY expect that a large historical library will be developed in connection with each dental teaching center. These libraries have drawn and will continue to draw upon the accumulated dental literature until it is exhausted. Such libraries are necessary when one wishes to make an exhaustive study of any subject; but one or two such libraries in each large center of population are quite sufficient. Such libraries should be so located that the student of dentistry as well as the practitioners in any city will enjoy their privileges for obvious reasons. There has been a great tendency for students of dentistry to cease the use of the dental library upon graduation; but we believe we now see an increasing number of young practitioners continuing the use of books after graduation and we feel that this Association should encourage the habit of regular reading of our current literature and books. One's college textbooks form a good nucleus about which to build a private professional library. Students should be urged to subscribe for a few of the best dental magazines. These they should learn to read in their student days and should continue to subscribe for these magazines after graduation. These magazines should be kept and when finances permit may be bound.

While the literature of the past is always desirable, most of us are looking for up-to-date ideas when we consult our libraries; therefore it is the magazines and books of our own time that are of most value to us. The Library and Museum Association should encourage the development of private libraries as one of the best means of advancing our profession. May we change the common and true idea that we are not a reading profession. Small private dental libraries will be a valuable heritage of the next generation, for many of our present dentists will have sons following in their footsteps, who will value their fathers' libraries. There is nothing in my home that so holds the attention of visiting dentists as my father's library. There is nothing in any home that exerts as refining an influence as a library.

We should open the exchange and sale privilege to all dentists interested and not restrict it to a few large institutions, for by fostering the reading habit and the development of libraries and museums we are training others to carry on our work.

My plea is that we as a library association urge dentists to retain in their possession complete files of the best magazines published during their professional lives. More than this we should urge dentists to use their libraries. Further, we should encourage dentists to accumulate museum specimens; and then to consult the large historical libraries before presenting a "new idea" to the profession, for many a "new idea" will be found to have been fully considered a generation or so ago in the literature of our profession.

SHOWING THE POSSIBILITIES OF STARCH DIGESTION IN THE MOUTH[1] *

By THOMAS B. HARTZELL, M.D., D.M.D., F.A.C.D., Minneapolis, Minnesota

BY MOST scientists it is believed that salivary digestion is a relatively unimportant part of digestion in general. But it seems to me that it deserves more attention, and that it is more important than is commonly believed.

Ptyalin is a mixture of enzymes. It contains an amylase, which digests starch changing it into dextrin, or starch gum. It also contains an enzyme, dextrinase, which changes dextrin into maltose, or sugar of malt. These two are the most important. The third enzyme, maltose, splits maltose into two molecules of glucose, the sugar of fruits, syrups, etc., which we assimilate and use to create energy.

The process of salivary digestion is therefore a change from starch to maltose and to a less extent to glucose. It is begun in the mouth during the chewing, where the saliva is mixed with the food, and continues in the stomach after swallowing until the acidity of the stomach has stopped the action.

Let us now examine the results of the following experiments to illustrate the effect of chewing starches. In all cases the results are expressed as per cent of glucose in the food as weighed without drying.

On chart I, curve I shows the increase of glucose from about 2.5 per cent in the bread, to about 20 per cent in 5 minutes and 32.5 per cent in 12 minutes. In this experiment 4.5 gms. of white bread was chewed one minute, put into a small beaker and weighed, the increase of 5.9 gms. being due to the saliva added. Due to the work involved, the first sample for analysis could not be taken until after 5½ minutes, but this nevertheless shows the rapidity of digestion. The total starch expressed as glucose in the bread is about 41 per cent. Comparing this with values interpolated from the curve,—we see that during the actual chewing, in one minute, the glucose in the bread increased to about 12 per cent of the possible total, in two minutes to about 22 per cent, in five minutes to about 50 per cent, and in twelve minutes to about 80 per cent of the total. In other words if this mouthful had been swallowed instead, about 80 per cent of the starch would have been digested 12 minutes afterward.

Curve II shows the results of another experiment on white bread where 4.0 gms. of bread was chewed for only one-half minute, thereby adding only 2.5 gms. of saliva, less than half of that used in the first experiment. We can readily

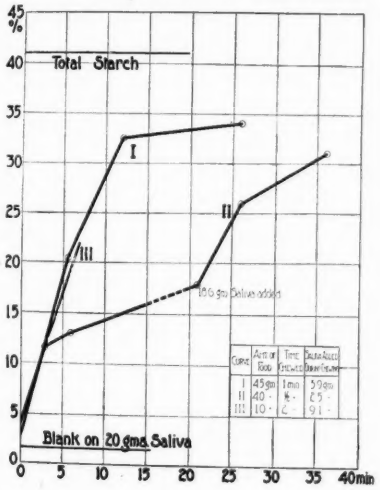
[1]Part of the original article "Ten Years to Life," published in *Jour. Amer. Dental Assoc.*, October, 1922, p. 831.

*I am indebted to Dr. David O. Spriestersbach, of the department of Bacteriology, School of Medicine, University of Minnesota, for the chemical determinations in this paper.

see that in 15 minutes, only 40 per cent of the total is digested, and that after 21 minutes where 18.6 gms. of saliva was directly added to it and mixed, that the digestion took place more rapidly than before, and in 15 minutes more, had almost caught up with the previous experiment.

In Chart II, curve I again shows the effect of a large bite of soda cracker

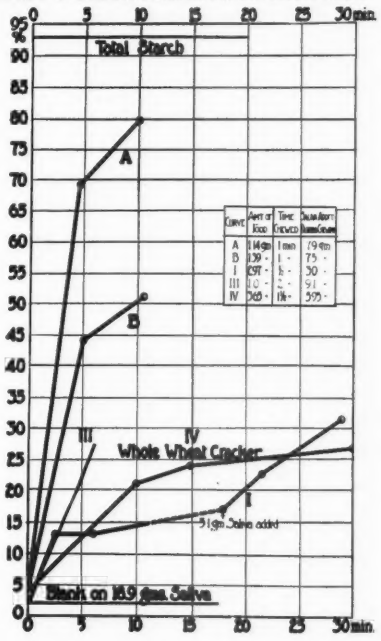
CHART I. SALIVARY DIGESTION ON WHITE BREAD



(not salted) 2.97 gms. chewed for only one-half minute, and with only 3.0 gms, of saliva added. The first determination of the sugar is a few per cent too high due to an unavoidable error. One can readily see, however, that one-half minute of chewing was not by any means enough for almost 3.0 gms. of soda cracker, although its consistency was like soft dough, and could have been easily swallowed. On the addition of only 5.1 gms. more of saliva after eighteen minutes, the curve here also goes rapidly on the up-grade.

Curve III shows the effect of chewing a small bite 1.0 gm. for two minutes, and keeping it in the mouth for three minutes more, which has added 9.1 gms. of saliva and after 6 minutes shows about 30 per cent total digestion. Further determinations were not made

CHART II. SALIVARY DIGESTION ON SODA CRACKER



but the curve shows the trend of the digestion.

Curve A shows the effect of chewing 1.14 gms. cracker for 1 minute which added 7.9 gms. of saliva. In this experiment about 75 per cent of the total starch was digested in 4½ minutes and 86 per cent in 10 minutes.

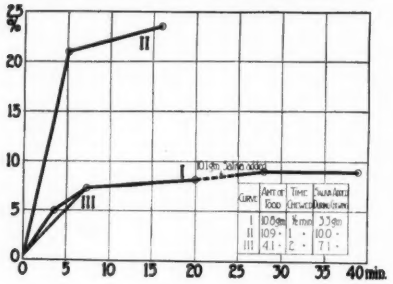
Curve B shows the same general effect, but the digestive strength of the saliva was weaker, due to the fact that experiment A was done just one-half hour earlier. All the other experiments were

done just before the noon lunch hour, when one would expect an active saliva.

Curve IV for the whole wheat cracker, shows the results of experiment made and gave reason to perform the other experiments under more favorable conditions. The total starch in the cracker was not determined but was much lower than in the soda cracker.

Chart III shows in general similar results to the others obtained with cold boiled potato. One would expect that boiled potato would give results similar

CHART III. SALIVARY DIGESTION ON COLD BOILED POTATO


%
25
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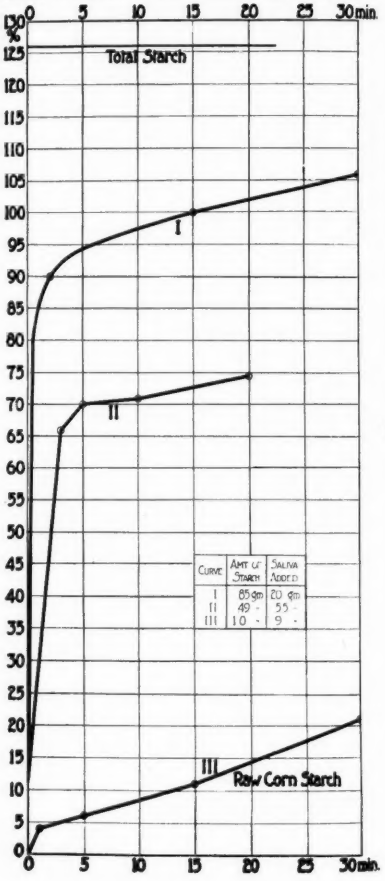
15
10
5
0
0 5 10 15 20 25 30 35 40 min.
II
I
III
10 cm. Saliva added
Curve | Amt of Food | Time Chewed | Saliva Added | Saliva Absorbed
I | 10.6 gm | 9 min | 3.5 gm |
II | 10.9 " | 1 " | 10.0 "
III | 4.1 " | 2 " | 7.1 "

to bread which it has done, being very similar in chemical composition.

In Chart IV, the results of experiments are given upon a starch paste made with cornstarch. These were not chewing experiments. Curve I shows the effect of the addition of 20 gms. of saliva to 25 cc. of about 4 per cent starch paste containing .85 gms. of cornstarch. We see that at the end of two minutes, about 70 per cent of the total starch was digested. Curve II shows the effect of 5.5 gms. saliva upon about .5 gm. starch, the general curve being similar, but the amount of digestion being more of the order of the chewing experiments where similar quantities of starch and saliva were used. However, on foods, such as starch puddings, not nearly so great quantities of saliva are added during eating, because as a rule they are not chewed nor kept in the mouth more than an instant of time.

CHART IV. ACTION OF SALIVA UPON STARCH PASTE



This chart shows how almost instantaneously ptyalin may act under the most favorable conditions.

Chart IV also shows what a relatively little digestion takes place upon only 1 gm. of raw cornstarch even with 9.0 gm. of saliva added.

All experiments were done under as carefully controlled conditions as possible in regard to temperature, considering the nature of the experiments. There is bound to be unavoidable loss during chewing and a decrease in temperature during weighing of samples for analysis.

One must, of course, take into consideration, the variations in the activity of one's saliva at different times, and the variation between individuals. But everything considered, for any individual, the optimum conditions for efficient salivary digestion are the following: 1, small bites of food; 2, longer and more efficient chewing; and 3, eat starchy foods first at a meal while the saliva has its greatest activity.

Under these conditions, allowing for variations in starch content of food, and activity of saliva, it is safe to say, I believe, that in the first minute of actual chewing, 10 to 20 per cent of the total starch is digested, and within 5 minutes, after the food has been chewed and swallowed, that 30 to 75 per cent of the starch is digested. The effect of the acidity of the stomach is at first to aid the salivary digestion, and only after a considerable time will the increased acidity stop it. Thus we see that if the conditions are made right for maximum digestion, namely, that every gram of starch be wetted with saliva, that there will be ample time for the process of starch reduction to come to completion in the stomach, as food remains for several moments in the cardiac end of the stomach before peristalsis disturbs and mixes it with the acid juice of the stomach. This will leave a relatively small amount of starch undigested, and will not require the pancreas to finish the digestion of large amounts of remaining starch in the intestines.

Therefore, the chewing of our food thoroughly is fully justified, in that a velocity of salivary digestion is thereby created in the mouth, and carried on in the stomach after swallowing, which brings about almost complete digestion of starch within a relatively short time.

THE MUTUAL RELATIONS OF SPECIALISTS AND GENERAL PRACTITIONERS OF DENTISTRY

By EDMUND NOYES, D.D.S., Chicago, Illinois

(Read before the North Shore Branch of the Chicago Dental Society, January 17, 1922)

NO ONE has a right to announce himself as a specialist unless he has made exhaustive study of his specialty and acquired unusual skill in the practice of it. The law requires of the general practitioner that he possess ordinary knowledge and ordinary skill in everything pertaining to his practice, but the law requires of the specialist that he know practically everything about his specialty, and that he possess much more than the ordinary skill required of the general practitioner.

It is my belief that general practitioners could wisely make more use of specialists than many of them do, depending of course upon the accessibility of specialists to themselves and their patients. Most men would find it beneficial to themselves and their patients to send extracting to a specialist, but formerly, and I presume it is so now, extracting specialists in a comparatively short time acquire an independent practice and receive from general practitioners only a small fraction of their practice.

The specialty of full denture prosthesis should be developed to a greater extent than at present. Partial dentures, where a considerable portion of the natural denture remains to guide the operator, can be well done by the general practitioner, but there are few things in dentistry, perhaps none, in a large proportion of cases that are so exacting and difficult as the making of full upper and lower sets of teeth, if the functions of mastication and speech are to be fully restored and the form and expression of the features are made as nearly normal as possible. It requires a technical and artistic skill closely akin to that of the sculptor or painter, but no patient with a perfect set of teeth can be hung up in an art gallery for all beholders to admire, and so give the dentist the fame he deserves. Dr. Haskell tried to practice such a specialty but the profession would not support him enough to give him a sufficient practice. Let us hope the time is now ripe for the successful development of such a specialty.

Of all the specialties I believe that orthodontia should be the most exclusively special of any, and it would be better for the little children if it were as rare for a general practitioner to undertake an orthodontia case as it is for him to undertake either the surgical or mechanical treatment of a cleft palate case. That is probably too strong a statement for there are doubtless places and circumstances in which it is urgently necessary for a general practitioner to do some such work, but he should do it in consultation with a

specialist. The cases are numerous enough in which children have been cruelly treated for years, with a final result worse than if nothing had been attempted, to counter-balance the benefit of a good many simple cases successfully treated. I am tempted to say that if the schools would graduate their men with enough instruction in orthodontia to make them realize that they are totally incompetent to practice it, they would render a better service to the public who need orthodontia service.

The specialist should receive larger fees than the general practitioner for making the same operations. That point does not need any argument. However, the fees of the specialist should not be so large that an ordinary dentist does not dare to send any of his patients to him. It is unfortunate for all concerned when a man comes back to his dentist after paying a specialist's fee and says: "I am not in the habit of questioning the fees of a professional man but I cannot avoid the opinion that if this specialist's fees are reasonable, yours are very much too small."

The codes of ethics, both dental and medical, explicitly forbid the giving or receiving of commissions or the splitting of fees. It is true that the dentist renders the specialist a service when he recommends patients to him and if the specialist's practice is chiefly derived from the profession it is an important service, but it is a kind of service that cannot be bought or sold by self-respecting people.

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VOL. 10 JANUARY, 1923 NO. 1

Editorial Department

WHAT OF 1923?

At this season of the year when the vision changes from one of retrospect to one of prospect—when the mellowing memories of the Yuletide give way to the sterner necessities of planning for the year to come, when the rounding out of the cycle brings us face to face with the ever-recurrent problem of putting our professional house in order—when in other words, we take stock and start over again—it is well to formulate our policies for the coming twelvemonth with some degree of definiteness. Dentistry never needed the stabilizing influence of careful, conservative, and constructive thinking and acting as it needs it today.

The fads, fancies and observations of the past few years must "give

us pause," and make us wonder if there is not a safer and saner way of doing things. The profession seems to periodically lose its balance and run off after false gods, which is only another way of saying that it is human. As soon as we become divine we will not do these things, but gentle reader, that will be long after you and I are gathered benevolently to our fathers. We must take the profession as it is today and deal with it in the light of its human limitations. And some of these limitations have been so pronounced in the recent past that they demand special attention at this, the beginning of a new year.

We seriously hope that in the coming twelve months there will be fewer good serviceable and normal teeth extracted "on suspicion," than have been sacrificed during the year just past. We trust that the rank and file of the profession will look more carefully into the prevention of oral disease, and into its care after it has begun. We trust that a dentist will become known as a man of serious thought when it relates to the welfare of his patient, that there will be less of the routine and slip-shod, and more of the concentrated and even the consecrated in his attitude to the various problems that come to him day after day. Let it be recalled that we are dealing each hour with the intricate issues of human weal or woe, that a mistake may mar the efficiency of a patient through life, or a master stroke may save that patient from endless suffering. Our work is not merely mechanical—it is often vital. Let us accept our service in a serious vein, and approach our duties with a real sense of the moral responsibility involved.

At the opening of the new year let us have a definite aim. Merely drifting will bring us nowhere—will land us in no port of promise. We should map our course with a tangible idea of whither we wish to sail, and then steer in that direction and hold steadfastly against adverse winds and cross currents till we anchor safely in the harbor of achievement. Back of every accomplishment there must be resolve, and following every resolution there must be the strong white light of purpose.

Every dentist will achieve more for himself and his profession in 1923 if he formulates his plans at the beginning of the cycle, and then runs true to form throughout the year. Do not accept this as "just another year." Look upon it as a renewed opportunity for bigger and better service, and be thankful that it is your privilege to serve humanity in so fine and rare a relationship as that of the practice of dentistry.

If every member of the American Dental Association would approach the coming twelve months in this attitude of mind, it would add immeasurably to the sum total of our professional achievement, and send the association and the profession ahead at a pace that has never before been attained. Let us make 1923 memorable by having a definite aim, and following it to a successful issue.

A TRIBUTE TO OUR FRIEND THE DENTIST

Our relation to the dentist is an interesting one. He relieves our ills, repairs our negligence and blunders, usually with sympathy and skill. With friendly insight he tells us the story of our misconduct. With plain, direct wisdom he counsels us as to daily conduct and practice. His warnings are based on facts with little of theory.

The skill of an able dentist is a matter of mystery and admiration. His craftsmanship runs into delicate surgery, or is akin to that of the artisan in jewelry. One remarked to us with modesty: "A dentist is a super-tinker." From that array of tiny instruments he must select just the right one for use in a minute, often obscure, spot. He must apply force with amazing nicety. Behind the infinitesimal though hard wall is the nerve. With only experience and judgment to guide him, the dentist measures its thickness as with an instrument of precision; he determines its degree of resistance to his knawing tool. A miscalculation and his work is lost; the plan of restoration destroyed—and, important to us, shrill pain and maybe the loss of a tooth. Yet we seldom hear of such mishaps. Our own experience reports no such happening, and suggests only admiration for the skill, gentleness, and wisdom of the dentist.

We like them, too, on their personal side. Those we know have an amusing knowledge of human nature, seen in miniature crises that display it brazenly. With exhibits of weakness, cowardice, even, they are very tolerant. We like their testimony to the nerve and courage of women. They seem to have a tireless interest in their patients as cases and as persons.

Because of the skill of its practitioners, and of their public and individual service in matters of health, dentistry stands high among the benign professions. Happy the man, and happy the family, that has a good dentist!—*Collier's*, December 9, 1922.

December 19, 1922.

Dear Editor:

Enclosed find my mite to a mighty good cause. May never a worthy dentist need it, or an unworthy one get it.

Wishing all the joys of the season to you and yours, I am

Sincerely,

Clarence O. Simpson,

St. Louis, Mo.

OBITUARY

JOHN SAYRE MARSHALL, M.D., SC.D., F.A.C.S.

John Sayre Marshall who died November 20, 1922, in California, in his 77th year, was born at Turnbridge Wells, England, June 26, 1846, and came to the United States in 1858, locating with his parents in Dewitt, Onondaga county, New York. He attended public school, and during the Civil War he joined Company "G", Second New York Cavalry Volunteers, taking part in many important engagements. He was mustered out of service June 5, 1865.

In 1868 Dr. Marshall was graduated from the Foyetteville Academy, and the following year he entered the office of Dr. Frank G. Tibbitts, and later studied with Dr. Charles H. Forman of Syracuse. He passed the Board of Censors of the Fifth District Dental Society in 1869, and began practice for himself. In 1870 he married Belle M. Carter of Syracuse. In 1873 he entered the College of Medicine of the University of Syracuse, and was graduated three years later as Doctor of Medicine.

He moved to Chicago, Illinois, in 1882, and became instructor of dental and oral surgery in the Faculty of Medicine of Northwestern University, and associated himself with Dr. W. W. Allport in dental practice. He organized the dental department of Northwestern University, and was Dean and Professor of Dental Pathology and Oral Surgery until he resigned in 1890.

In 1892 he reorganized the American College of Dental Surgery, and became its Dean and Professor of Oral Surgery; holding these positions until the consolidation of the American and Northwestern four years later.

In 1901 he again entered the Army as President of the Board of Examiners of the newly authorized corps of Dental Surgery, and it was probably in this capacity that he gave the most distinguished service to his country and to the profession. He did a great work in helping to organize the Dental Corps, and remained in the service until June, 1911. Coincident with his retirement he was given the grade of Captain on the retired list by reason of his Civil War record.

In 1910 the University of Syracuse conferred on him the Degree of Doctor of Science; and in 1914 he was honored by being elected a Fellow of the American College of Surgeons.

He was the author of the following books: "Injuries and Surgical Diseases of the Face, Mouth and Jaws," "A Text Book of Operative Dentistry," and "Mouth Hygiene." He was also a liberal contributor to our periodical literature.

He is survived by his widow, Mrs. Josephine Knowles Marshall, and a son, Dr. John A. Marshall, of the College of Dentistry, University of California.

Dr. Marshall was a man of outstanding achievements in military and professional life. From the time of his enlistment as a mere boy in the Civil War, on down through his career as a dental practitioner and teacher, and to his final great work in the organization of the army Dental Corps, his progress was marked by painstaking effort and signal ability. He has left a record of achievement which stamped him as a man useful to his age and generation, and a heritage of honorable attainment as a fitting legacy to his family and friends.

Medical and Dental News

(Dentists will confer a favor by sending to this department items of news of more or less general interest; such as relate to society activities, education, public health, mouth hygiene, etc.)

CALIFORNIA

Health Teaching in San Francisco School: The California representative of the Child Health Organization has been requested by the San Francisco Board of Education to make out a monthly program of health teaching for the city schools. A health program tried out last year in two schools was so successful that it has been extended to 10 more.—Monthly Digest, Nat. Health Council, November, 1922.

"Handling the Health Problem of School Children in San Francisco." By Philip King Brown, M. D., Chairman, Committee on Nutrition, San Francisco Tuberculosis Association. Reprinted from the American Journal of Clinical Medicine, September, 1922.

An account of San Francisco's survey to determine the physical condition of its school children and the plan adopted for solving the problem of under-nourishment without cost to the taxpayers.

A Course of Training for students desiring to qualify for the task of supervising child-caring institutions has been instituted at the State Teachers' College at Santa Barbara. The proposed course will include in addition to regular instruction regarding institutional management lectures on child hygiene, nutrition, psychology, sociology, and a specified period of field work in certain approved orphanages. (Letter of Calif. State Dept. of Finance, to directors and superintendents of institutions, through the Bureau of Children's Aid, Sacramento, November 10, 1922.)

DELAWARE

Commission on Public Health and Welfare: At a recent meeting at Dover, representatives of the Child Welfare Commission, the Juvenile Court, the Juvenile Court Association, the Society for the Prevention of Cruelty to Children, the Mothers' Pension Commission, and the State Board of Charities adopted a resolution requesting the governor to recommend legislation doing away with all the various commissions and boards in the state having to do with public health or welfare, and creating instead a new commission to be known as a Commission on Public Health and Welfare.

In addition to its other activities, this commission would have authority to license, inspect, and require reports from all agencies and institutions having to do with children.—Interview with Director of the Delaware Child Welfare Commission.

DISTRICT OF COLUMBIA

The Nutrition Clinics for children of the public schools have been resumed by the Washington Tuberculosis Association. Seventeen clinics will be maintained this season, of which two will be at the Children's Hospital, one at the headquarters of the association, and the others at public schools. Last year the association conducted 16 clinics each week for 20 weeks, with an enrollment of 344 children, selected because they were at least 10 per cent underweight.—Washington Star, November 5, 1922.

ILLINOIS

Good Health Week to Become Annual Affair: "That health has been conserved and lives saved by the Good Health week just closed is entirely beyond question," is the statement of William E. Worth, vice-president of the industrial division of the Chicago Safety Council in charge of this campaign, which closed October 30. "Association of Commerce

members and the public generally have responded in a gratifying manner to this plan and substantial progress has thus been made in impressing people with the rudiments of sanitation, personal hygiene, ventilation and related subjects. We have had the cooperation of the health department and of many other agencies and the campaign has functioned intensely."

Continuing, Mr. Worth said: "The war and its many drives taught all of us valuable lessons in 'campaigning' and the Safety Council has applied that experience effectively in advancing interest not only in health but in the prevention of accidents and fires.

"Posters, placards and other material were posted in many industrial establishments and such wide notice accorded the plan that every resident of the city has become more or less imbued with the idea that health is a valuable asset from the standpoint of increased earning capacity, reduction of time lost because of sickness and greater efficiency, to say nothing of the added enjoyment of life which comes from a healthy body and a clean mind.

"This campaign, national in scope, will now be carried on annually throughout the country, those in charge having in mind the old axiom that 'the health of the nation is the wealth of the nation.'"

It is said that this is the first instance when, in such a large way, the medical profession and the industrial leaders of the country have joined together on problems of health. It is evident that people are coming to think of health in terms of prevention rather than cure.

"Community Dental Service:" Dental Needs and Facilities with Special Reference to a Dental Program for Chicago." By Michael M. Davis, Jr., Ph. D.

A report of a survey conducted by Dr. Davis early in 1921 at the request of Mr. Julius Rosenwald, under the auspices of the Service Bureau of Dispensaries and Community Relations of Hospitals of the American Hospital Association, Chicago. The report includes studies of the dental facilities provided in a number of large cities and smaller communities, and makes recommendations for Chicago.

New Chicago Dental Clinic Will Care for 50,000 Needy Children Annually: Chicago's international prestige as the world's greatest center of dentistry is to be greatly increased by the building of the Chicago Training School for Home and Public Health Nursing and Children's Dental Clinic, work on which will begin February 15, it was officially announced last night. This is the project originated by Dr. John Dill Robertson and financed with profits of the Pageant of Progress.

Architect Frank O. De Money has drawn plans for a 161x80 building to stand on a 190x90 lot at the northeast corner of Loomis and Monroe, and to cost approximately $200,000. It will be completed some time during the summer.

According to Dr. Robertson there'll be fifty chairs in the children's dental clinic which he conservatively estimates will care for 50,000 needy youngsters' dental woes each year. At present the clinic has four chairs in rented quarters. A nominal charge of five cents for each child will be made as it is done in the big Forsythe Dental infirmary in Boston. The new Chicago clinic, by the way, will be as big as the famous Forsythe infirmary and render as much service, says Dr. Robertson.

There are three great dental institutions in Chicago; the dental school of Northwestern University, the Chicago College of Dental Surgery, the oldest, and the dental college of the University of Illinois. Arrangements are being made with these to furnish the staff of the clinic from their senior classes.

The home nursing school, which has had 11,000 students take the eight weeks' course during the last three years, will occupy the balance of the building. Later on Dr. Robertson said a dental hygiene school, for nurses who act as assistants to dentists, probably will be installed.

Dr. Robertson is president of the board of directors. Others on the board are Dr. W. A. Evans, health editor of The Tribune, D. F. Kelly, new head of the Chicago Fair, Edgar A. Jonas, Dr. C. N. Johnson, dean of students of the Chicago College of Dental Surgery, Mayor Thompson, and Daniel Norman, vice-president of the Continental & Commercial National bank, and also treasurer of the project. The late Bishop Samuel Fallows was president, preceding Dr. Robertson.—Chicago Tribune, December 22, 1922.

Dental Clinic for School Children Opened by N. W. U.: Northwestern University formally opened a new dental clinic for children last Wednesday afternoon in its Chicago building at Lake and Dearborn streets. Fifteen small dental chairs, made especially for the school children, were put into operation with many of Chicago's leading professional and business men present to view the new work. Dean Arthur D. Black, a group of

alumni of Northwestern and other friends of the university have established this clinic, Dean Black announced, at a total expenditure of nearly $60,000. A deficit of about $9,000 a year has been guaranteed by a generous Chicagoan.

All children entering the clinic will be supplied with toothbrushes and all will be required to participate in toothbrush drills. Northwestern University Dental School seniors will act as operatives for the children and by this arrangement Dean Black estimates that the cost per chair will not run above $600 the first year, compared with $1,550 at Bridgeport, Connecticut, and as high as $4,000 at other eastern points.

Dean Black said that at present twenty children are coming to the clinic daily and it is estimated that each child will require from four to five visits, thus bringing the total visiting number daily under full operation to between eighty and one hundred. Health Commissioner Bundesen of Chicago is actively co-operating, the dean added, and a majority of the children are brought by nurses from the lower grades of the Chicago public schools. Nutrition and related physical problems will be reported upon by the Northwestern experts, as well as tooth and mouth conditions. Provisions for X-Ray and radiographic work have also been made by Northwestern University.—Chicago Commerce, December 16, 1922.

Children's Clinic in Decatur, Illinois: Our clinic was started about six years ago. During the first year, various members of the local society assumed the responsibility of the clinic but this arrangement was not successful. It was then given to one man, my predecessor, who held the position for three years. This is my second year. The clinic has grown to a point where we are increasing the time from two to three mornings per week.

We now have permanent quarters in a centrally located school building including a large reception room with chairs and a bed, a large operating room fairly well equipped and another room where the histories are taken and the records kept.

The children cared for are all indigent. No charge is made for any dental service. We do everything but gold work. A record is made of every case and the children are returned from time to time for inspection and additional work.

Last year with two mornings per week we took care of more than six hundred and fifty children. With an added morning the number will be greater this year. There is really work enough of strictly clinic cases to keep a full time dentist busy. It is our hope and ambition that this can some time be done.

The following figures cover a survey made of two of the local schools. Most of our clinic cases come from these two localities. At a conservative estimate these will add during the next year three hundred new cases to the clinic. The figures are self-explanatory with the exception that of the seventy-six children having had previous dental attention probably one-third had the work done in the clinic.

Total number of children examined	994
Total number of Boys	490
Total number of Girls	504
Total number needing Prophylaxis	393
Total number needing Orthodontic interference	136
Total number of fillings in permanent teeth necessary	1022
Total number of extractions of permanent teeth necessary	73
Total number of fillings in temporary teeth necessary	133
Total number of extractions of temporary teeth necessary	2387
Total number of deformed teeth	14
Total number of permanent teeth previously extracted	50
Total number having had previous dental attention	76
Total number not needing dental service	78

Range in age—6-14 years.

Survery made November 1922. Durfee and Jasper Schools.

This care of needy children is a wonderful work and there is no reason why any community, so inclined, cannot do this. Our particular clinic is financed by the local Bureau of Social Service.—H. L. Freidinger, D. D. S., Director of Clinic.

KANSAS

Child Labor in the Sugar-Beet Fields: An investigation by the welfare department of the industrial court has shown that a large number of children are taken out of school each year to work in the beet harvest, which begins in the middle of October, and lasts for two months. In some instances the children work from daylight to dark and the investigator found children as young as 6 years of age at work in the fields. The welfare department will appeal to the next legislation for changes in the laws that will enable the authorities to correct these conditions.—Kansas City Post, October 30, 1922.

MINNESOTA

"The Game of Health in Minneapolis Schools:" By Nils Juell, D. D. S., Chairman Health Promotion Committee, Minneapolis Board of Education.—Nation's Health, October, 1922.

A Hospital and School Has Been Opened in Minneapolis for Tuberculosis Children who are well enough to attend school but who are prohibited from attending regular classes because they might infect other children. The institution is described in detail in the Nation's Health, Chicago, November, 1922.

MISSOURI

"The St. Louis Study Club of Dentistry" has justified its existence. After four consecutive years of dental study club work, this unique organization formulated for the purpose of assisting all ethical graduate dentists in obtaining, free of charge, advanced instruction in the various branches of their profession, has by the acid test of practical application emerged into a happy permanent institution.

The enrollment of one hundred and seventy dentists for the fall and winter session 1921-22 has bridged the stream of doubt and experiment, placing the "St. Louis Study Club" in that field of permanent stability, a monument to the higher ideals, which actuate all dentists who would improve their daily technic by giving a part of their leisure time in attendance to classes.

More complete information may be obtained from Dr. Max Fendler, Central National Bank Building, St. Louis, Mo.

NORTH CAROLINA

Approximately 60,000 More Children Attended the Public Schools last year than during the preceding year. This increase is largely attributable to the new compulsory school attendance law which requires children to enter school at the age of 7 instead of 8, as under the old law.—Public Welfare Progress, State Board of Charities and Public Welfare, Raleigh, North Carolina.

NEW JERSEY

A Back-to-School Drive was conducted during the past summer by the Rotary Club of Newark, where a study of high school records had revealed the fact that there was a great falling off in the number of students between the grammar grades and high school. A letter was sent to each boy graduating from the grammar school in June, setting forth the advantages of going to high school. Return postals were enclosed with four questions to be answered: (1) Do you expect to enter high school? (2) If not, is it because your parents feel that they can not afford it? (3) What business or profession are you interested in? (4) Would you like an interview with a business man regarding your future? Many cards were returned, and the boys who replied were referred to individual Rotarians for assistance. — Nation's Health, October, 1922.

NEW YORK

A Stay-in-School Drive will be conducted by the Women's City Club, New York City, November 27 to December 9, with the object of inducing children in the elementary schools to continue their education and register for high school. About 20 social and civic agencies of the city will assist. Speakers will be sent to the schools, parents' meetings will be held, and pamphlets in several languages will be given wide circulation.—Better Times, New York City, November, 1922.

OREGON

Public School Bill: In a referendum November 7, voters of Oregon, by a decisive majority, expressed themselves in favor of a law requiring that children between the ages of 8 and 16 be sent to the public schools, except in cases where they are physically or mentally incapacitated or live at inconvenient distances from school centers. This action practically abolishes church and private schools for children of grammar-school age, except in certain specified and approved instances. Opponents of the measure have announced that they will carry their fight to the courts.—Washington Herald, November 10, 1922.

PENNSYLVANIA

Ten Clinics for the Prevention of Heart Disease among children have been opened in congested sections of Philadelphia by the city health department. The work will be conducted by physicians of the Division of Child Hygiene, under the supervision of Health Director Furbush. Children who are susceptible to heart trouble as a result of contagious diseases will be examined, and an educational campaign will be conducted.—Jour. Amer. Med. Assoc., October 7, 1922.

WYOMING

Classes for Defectives: To encourage the formation of classes for subnormal and defective children, the Wyoming State Board of Education pays a bonus of $150 at the end of the school year to

any school board which has established an approved special class. Such classes must conform to certain requirements such as the holding of special certificates by the teachers, the provision of suitable equipment, and the examination of pupils by standardized mental tests.—School Life, October, 1922.

GENERAL

A Traveling Child Welfare Exhibit is journeying through the larger towns of Derbyshire County. The exhibit features prenatal care, clothing and food of young children, care of the teeth, common ailments of children, and home surroundings. Special attention is paid to the instruction of school children and girls over twelve are excused from school to attend.—National Health, October, 1922.

The Constitutionality of School Vaccination Laws has been upheld by a decision of the United States Supreme Court, rendered on November 13, which declares that state and municipal authorities have the right under the Constitution to make and enforce health laws.—Chr. Sc. Monitor, November 13, 1922.

The Slaughter of the Innocents: Two more children have been offered up as sacrifices to the theological views of undoubtedly sincere but certainly misguided parents. It is none of the public's business! One of the parents says it isn't! In Cincinnati a 15-year-old high school girl was taken sick on October 24. Her mother had faith in divine healing and therefore did not call a physician. Nine days later events had shaken her faith enough to make her willing that a physician be called but not enough to make her willing that the physician should administer antitoxin. The girl died the next day. In Spokane, Washington, under "Christian science treatment," John Earl Halverson, 6 years and 11 months old, died November 19, from diphtheria after a week's illness. The father stated to the press his views as follows: "We are Christian scientists and do not believe in doctors or antitoxins, so no doctor was called. I see no reason for making any fuss over this case any more than over any other death. The public is not interested in what the child died of, and I wish you would not make mention of the case."—Jour. of the Amer. Med. Assoc., December 9, 1922.

The Rhodesian Skull: The Rhodesian skull was described by Professor A. Smith Woodward at the recent British Association meeting at Hull. He lovingly handled a copy made for the British Museum and dwelt with an almost aesthetic joy on the main features. The skull came from what he called a completely modern cave in the Broken Hill mines. The word "modern" he used in a Pickwickian, that is to say, palaeontological, sense. The brain case, he said, was not by itself astonishing, but the face amazed him. It must have been the largest ever seen. Especially remarkable were the brow ridges, which were like those of a gorilla. The maxillary bones were ape-like, the rest of the face was human. Various indications showed that the man belonged to a race verging on extinction. He must have suffered very badly from toothache, for there were signs of true caries. This reminds us that at a previous meeting we were told that prehistoric man in Norfolk suffered from pyorrhoea, which we thought was quite a modern thing. Perhaps when it is known that it is so old, it will cease to be fashionable in society. The Rhodesian man also had abscesses. The man's brain was very undeveloped, and in contrast to the Neanderthal man, he walked upright.—The Dental Practitioner, November, 1922.

The Prevalence of Dental Decay: Speaking of the percentages of physical defects in one form or another among the children under inspection, Sir George Newman says: "Dental decay is present in sixty to seventy per cent, and about twenty-five is in urgent need of treatment," and he goes on to remark, "if half the work and enthusiasm that has been put into the prevention of tuberculosis or into 'child welfare' had been directed to the prevention of dental troubles, the battle would now have been won." These are strong words, but is anyone conversant with the ravages upon the general health and physique directly attributable to septic teeth prepared to say that they are exaggerated? No, the further medical research is carried the more insistent becomes the argument which we have consistently supported, that the most economical provision for the health of the people is an efficient national dental service.—The Dental Practitioner, November, 1922.

To the Editor:—I am endeavoring to make a complete study of the distribution of human actinomycosis in this country. The number of cases reported in the literature is surprisingly small, and I know that the disease is not so rare as is sometimes thought. I shall greatly appreciate hearing directly from any one who has had experience with this disease,

and desire to know concerning case histories the following: age, sex, occupation, residence, state in which the disease was contracted, location of lesion, duration of symptoms, and any special points of interest connected with the treatment, outcome of the disease, or necropsy findings.—A. H. Sanford, M. D., Mayo Clinic, Rochester, Minnesota, December 11, 1922.

Hospital Aeroplane in Service: A new white hospital aeroplane, designed and built at McCook Field, has been received at the primary flying school at Brooks Field, Texas. This aeroplane is a remodeled Curtis J. N-6 equipped with a Wright motor, 80 horsepower. The fuselage is enlarged to accommodate a recumbent patient. A seat facing the patient, between the patient and the pilot, has been installed for an attendant. The aeroplane with full load has been given several test flights by pilots from the field, and it is reported that, although it is an ideal ambulance aeroplane so far as the patient's comfort is concerned, it is loggy, nose heavy and slightly overpowered.—Jour. of the Amer. Med. Assoc., November 11, 1922.

"Patent Medicine" Secrecy—A Tardy Admission: For years the medical profession has insisted that the real reason that nostrum makers keep the composition of their products secret is (1) for the glamour that such secrecy throws around them and (2) the fact that so long as the public does not know what is in a preparation the advertiser's imagination is given freer play. The unknown is always awe-inspiring. The "patent medicine" makers, on the other hand, have stoutly maintained that their reason for keeping the composition of their product secret is that the formula is personal property and, if it were made known, the market would be flooded with imitations, and their property destroyed. Now comes the mouthpiece of the "patent medicine" people. Standard Remedies, with the tardy admission that the medical profession is right and their own constituents wrong. Says this publication in an editorial "Formulae and Secrecy":

"It should be remembered that while a developed formula has a great value, it is the trade name, the advertising, the merchandising skill applied in connection with it that creates its valuable good will. Ten to one a thorough search through books of formulae will reveal that your own is already known to the medical world. But no one can get the same benefit from it that you have gained unless they spend in merchandising it the same money you have spent."

Elsewhere in the same editorial Standard Remedies admits that "the ingredients of some of the biggest selling proprietary medicines are duplicated in one way or another by imitators. Usually without profit." In other words, as The Journal has iterated and reiterated, the composition of the average "patent medicine" is usually the least commercially valuable thing about it. The real thing of commercial value is the NAME, which the manufacturer protects by a perpetual monopoly granted under the trademark law. Pink dishwater could be put on the market under some fancy name (trade-marked) and by persistent and insistent advertising built up into a large property. It it were nothing but pink dishwater, only advertising, of course, could keep it alive. Add a stiff dash of spiritus frumenti, or some equally intriguing drug, to the mixture and the composition alone might keep it moving after momentum had been given it by advertising. The claim long made by "patent medicine" makers that they had to keep the composition of their nostrums secret in order to protect themselves is buncombe because every "patent medicine" maker knows what Standard Remedies admits, that his preparation can be analyzed by any good chemist and duplicated. Now that the "patent medicine" people themselves acknowledge that the real commercial value of their products lies in the "development" that has been brought about by advertising, there is no longer any reason for our timid lawgivers shying at every "open formula" bill that may be introduced for the purpose of giving the drug-taking public a modicum, at least, of protection.—Jour. of the Amer. Med. Assoc., November 11, 1922.

Important Factor in Baby's Health: In a lecture recently given at the Royal Institute of Public Health on "Child Welfare," Professor Louise McIlroy, of London, said when a baby was found to be losing weight, and they could find nothing apparently the matter with it, a doctor or nurse should look at the mouth of the nursing mother. She had often found in such cases that the mother's mouth was unhealthy by reason of decayed teeth, but as soon as the mouth was cleaned and suitable treatment followed, the baby commenced to put on weight.—The Dental Surgeon, November 4, 1922.

The Improvement of the Nation's Teeth: In the course of an address on the care of the teeth which he read at a luncheon of the Bates Rotary Club, held at the beginning of the month, Mr. Stuart Carter stated that the British had the worst teeth of any nation in the world. In order to effect an amelioration of this lamentable state of affairs he offered four suggestions. First, there should be an organization of our educational forces. He did not suppose that one-half per cent of the money devoted to educational purposes in this country was spent on caring for the children's teeth; but children could not be expected to do such good school work if their teeth were not in a proper condition to enable them to obtain the best results from their food. Secondly, there should be closer co-operation between the health officers and the medical and dental officers. Thirdly, there should be a standardization of public health work. Fourthly, proper provision must be made for the payment of public health workers, so as to induce the right type of candidates to apply for such positions. The man who was best fitted for such a position of organization would probably do better for himself in private practice unless it were made worth his while to undertake the former work.—The Dental Surgeon, November 4, 1922.

Testimonial Banquet to Thomas J. Barrett: The Central District Massachusetts Dental Society is to give a complimentary dinner to Thomas J. Barrett, January 8, 1923 at the Bancroft Hotel, Worcester, Massachusetts, in recognition of Dr. Barrett's completion of thirty years' service as a member of the Massachusetts Board of Registration and Dentistry.

The Initial Number of the Vocational Education Magazine, to be published under the auspices of the National Society for Vocational Education, was issued in September, 1922. In his introductory statement, the editor, David Snedden of Teachers' College, states that the journal is to be devoted to the interests of special education for vocations other than the professions. It is published by the J. B. Lippincott Company, Philadelphia.

FOREIGN

"Infant Mortality and Preventive Work in New Zealand:" By Robert Morse Woodbury, United States Children's Bureau Publication No. 105.

This report points out the close relation between the organized infant-welfare work in New Zealand and the striking reduction in the number of infant deaths which has taken place in that country within the last 50 years. The New Zealand infant mortality rate is lower than that of any other country in the world; in 1919 the number of deaths of infants under one year of age was only 45 to every 1,000 births, as compared with 87 in the United States birth-registration area. The significance of the report lies in its indication that while moderate climate, racial homogeneity, good housing, and other conditions help to explain New Zealand's low rate, they do not account for the notable decrease in the rate in the last 50 years, since during this period improvements in these conditions either did not occur or were not pronounced. The reduction has been especially marked for the past 10 or 15 years, through a lessening of the number of deaths from gastric and intestinal diseases and from respiratory diseases. The most important influence in the recent reduction is undoubtedly the work of the Royal New Zealand Society for the Health of Women and Children, the report declares. This society, organized in 1907, is subsidized by the Government, and its work has extended to all the principal cities and many of the outlying regions of the Dominion.

German Dental Students: The crisis through which Germany has passed do not appear to have impaired the activities of the Universities of the Fatherland. On the contrary, the number of students attending shows a large increase upon the last pre-war figures. The increase is most pronounced in such departments as law and political science, dentistry, chemistry and pharmacy. To take the subject of most direct interest to our readers, in 1914, the number of dental students were as follows: Men, 932; women, 38. In 1921, the respective totals were 4,675 and 304. The expansion in both cases is remarkable and goes to suggest that Germany is not among the countries who are neglecting the lesson of the war respecting the importance of sound teeth to the national vitality.—The Dental Practitioner, November, 1922.

Uruguay. Dental Clinics in Montevideo: Four dental clinics are now in operation in Montevideo, according to the chief of the Uruguay school medical corps. During 1921, 1,870 school children were treated. So far, treatment has been limited to children under 12 years of age admitted to school during the year.—Jour. Amer. Med. Assoc., Chicago, November 25, 1922.

Announcements

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

American Dental Association, September 10-14, 1923, Cleveland, Ohio.

American Society of Orthodontists, April 9, 10, 11, 1923. Edgewater Beach Hotel, Chicago, Illinois.

American Medical Association, June 25 to 29, 1923, San Francisco, California.

American Academy of Periodontology, September 7 and 8, 1923, Statler Hotel, Cleveland, Ohio.

American Institute of Dental Teachers, January 22 to 25, 1923, Hotel Fontenelle, Omaha, Nebraska.

American Society of Oral Surgeons and Exodontists, September 4 to 7, 1923, Cleveland, Ohio.

National Society of Denture Prosthetists, August 27 to September 8, Cleveland, Ohio.

STATE SOCIETIES

February (1923)

Minnesota, at St. Paul (6-9).
Louisiana, at New Orleans (22, 23, 24).

March

Michigan at Detroit (27, 28, 29, 30, 31).
Vermont, at Burlington (21, 22, 23).

April

Alabama, at Birmingham (2nd Tuesday).
Connecticut, at Hartford (19, 20, 21).
Kentucky, at Louisville (16, 17, 18, 19).
Kansas, at Wichita.
Mississippi, at Laurel.
Missouri, at St. Louis.
New Jersey, at Trenton (11, 12, 13).
North Carolina-Virginia, at Pinehurst, N. C., (April 30, May 1, 2, 3).
Virginia, and North Carolina, at Pinehurst, N. C., (April 30, May, 1, 2, 3).

May

Illinois, at Decatur (8, 9, 10).
Indiana, at Indianapolis (14, 15, 16, 17).
Iowa, at Des Moines (1, 2, 3).
Massachusetts, at Boston (2, 3, 4).
Nebraska, at Omaha (14, 15, 16, 17).
New York, at New York City (9, 10, 11, 12).
Pennsylvania, at Philadelphia (15, 16, 17).
South Dakota, at Huron (10, 11, 12).
Tennessee, at Nashville (2, 3, 4, 5).
West Virginia, at Wheeling (21, 22, 23).

June

California, at San Francisco (11-15).
Colorado, Troutdale-in-the-pines, (14, 15, 16).
Idaho, at Boise.
New Hampshire, at The Weirs (21, 22).
Southern California, at Los Angeles.
Utah, at Salt Lake City.
Wyoming, at Loraine.

July

Montana, at Missoula.
Wisconsin, at Milwaukee (10, 11, 12).

PENNSYLVANIA STATE DENTAL SOCIETY

The fifty-fifth annual meeting of the Pennsylvania State Dental Society will be held in Philadelphia at the Bellevue Stratford Hotel, May 15, 16, 17, 1923.

All members of organized dentistry are cordially invited to attend.

A. C. BARCLAY, *Secretary*,
914-915 Highland Bldg., Pittsburg, Pa.

VIRGINIA-NORTH CAROLINA STATE DENTAL MEETING

The Virginia State Dental Association and the North Carolina Dental Society will hold a joint meeting at Pinehurst, N. C., April 30, May 1, 2 and 3, 1923. The headquarters will be at the Carolina Hotel.

A cordial invitation is extended to all ethical practitioners.

HARRY BEAR, (*Va.*) *Secretary*
410 Professional Bldg., Richmond, Va.
H. O. LINEBERGER, (*N. C.*) *Secretary*
Raleigh, N. C.

FORTIETH ANNUAL MEETING OF MINNESOTA STATE DENTAL ASSOCIATION

FEBRUARY 6, 7, 8, 9, 1923

ST. PAUL AUDITORIUM, ST. PAUL

The Minnesota State Dental Association wishes to extend a cordial invitation to all members of the American Dental Association and ethical non-members to attend the fortieth annual meeting to be held in the St. Paul Auditorium, St. Paul, Minnesota, February 6, 7, 8, 9, 1923.

The success of the arrangement of last year's meeting at the Minneapolis Armory caused the committee to pattern this coming meeting along similar lines, devoting the mornings to papers and lectures; and the afternoons to clinics, with the exception of Wednesday, when one lecture and the business meeting occupy the morning session, while one lecture and the exhibits consume the afternoon session.

TUESDAY, FEBRUARY 6, 1923

Crown and Bridge and Operative Dentistry

Morning

8:00 A. M.—Registration.

9:00 A. M. to 12:00 M.—Lectures by:

E. T. Tinker ..... Minneapolis, Minn.
"Fundamentals of Crown and Bridge Construction."

C. K. Bird ..... St. Paul, Minn.
"Balanced Occlusion in Fixed Reconstruction, Its meaning, and Methods of Obtaining It."

Chas. E. Woodbury ..... Council Bluffs, Iowa.
"The Making of Gold Foil Operations in the Six Anterior Teeth."

12:00 M. to 1:30 P. M.—Cafeteria Luncheon, Served by Women's Auxiliary of the St. Paul District Dental Society.

12:15 P. M. to 1:00 P. M.—Organ Recital—G. A. Thornton, Organist St. Clement's Church, St. Paul.

Afternoon

1:30 P. M. to 4:30 P. M.—Operative Gold Foil Clinics
Crown and Bridge Clinics
Porcelain Clinics
Operative Dentistry Clinics

Evening

6:00 P. M.—Annual State Society Banquet.

WEDNESDAY, FEBRUARY 7, 1923

Morning

9:00 A. M.—Lecture by Alfred Owre ..... Minneapolis, Minn.
Subject—"Dental Education."

10:00 A. M. to 12:00 M.—Business Meeting.

12:15 P. M. to 1:00 P. M.—Organ Recital During Luncheon Hour.

AFTERNOON

1:30 P. M.—Talk by Jos. Shellman .....St. Paul, Minn.
Subject—"Shall the Business Side of Dentistry Displace the Professional Side of Dentistry."

2:30 P. M. to 4:30 P. M.—Exhibits.

THURSDAY, FEBRUARY 8, 1923

Preventive Dentistry Day

MORNING

9:00 A. M. to 11:00 A. M.—Lecture—Wallace Seccombe, Royal College of Dental Surgeons, Toronto, Ontario.
Subject—"Dental Disturbances Due to Diet."

11:00 A. M. to 12:00 M.—Lecture—B. E. Lischer, Professor of Orthodontia, Washington University, St. Louis, Mo.
Subject—"The Dentist and the Orthodontic Problem."

12:15 P. M. to 1:00 P. M.—Organ Recital During Luncheon Hour.

AFTERNOON

1:30 P. M. to 4:30 P. M.—Orthodontia Section—Group Clinic presented by the Orthodontists of Minnesota.

Oral Hygiene Exhibits

General Table Clinics under Direction of Mark O. Nelson, St. Paul, Minn.

It is obvious that it would be impossible for the Superintendent of Clinics to accommodate in the various group clinics all of the members of our seven district societies who are qualified and prepared to give clinics. The general table clinics, however, afford us an opportunity of inviting all of these members to participate in our program. It is the desire this year to have a spirit of friendly rivalry among the various districts and we trust that all of the districts will enter into this with the proper spirit of co-operation. With a table clinic the clinician can have his listeners grouped around him in a friendly, informal way, and can clear up many problems by answering various questions put to him by his audience. We, therefore, invite you to participate in these clinics. If you have a table clinic to offer, kindly communicate immediately with Dr. Mark O. Nelson, Lowry Bldg., St. Paul, Minn., and he will see that you are properly cared for.

THURSDAY EVENING

Fraternity Banquets

FRIDAY, FEBRUARY 9, 1923

Full Denture Section, Exodontia and Conductive Anesthesia

MORNING

9:00 A. M.—Paper by Robert Gillis, Hammond, Ind., President of National Society of Denture Prosthetists.
Subject—"The Responsibility of the Dentist in Full Denture Service."

10:00 A. M.—Paper by H. J. Prentiss, University of Iowa, Department of Anatomy, Histology, Embryology and Neuro-Anatomy.
Subject—"Regional Anatomy, Emphasizing Mandibular Movements with Specific Reference to Full Denture Construction."

11:00 A. M.—Paper by J. A. Heidbrink .....Minneapolis, Minn.
Subject—"Some Considerations Pertaining to the Removal of Teeth and Mouth Infections."

12:15 P. M. to 1:00 P. M.—Organ Recital During Luncheon Hour.

AFTERNOON

1:30 P. M. to 4:30 P. M.—Group Clinics.

Full Dentures:

University of Minnesota Full Denture Clinic.
Monson Club Full Denture Clinic.
Conductive Anesthesia Clinic.
Twin City Exodontia Club Clinic.
(Operative and Table Clinics).

The Minnesota Dental Nurses' and Assistants' Association will hold their third annual meeting in the Lounge Room of the St. Paul Auditorium, Wednesday, February 7, 1923. A program of papers and clinics has been prepared and a cordial invitation is extended to all dental nurses, oral hygienists and dental assistants of the State Dental Association, and to others who desire to come and avail themselves of the privileges offered by this organization. A banquet in the evening has been arranged.

Your 1923 membership card will insure your entrance without delay.

Recapitulating, it is the desire of the committee to make this coming meeting a most profitable one for you. You owe it to yourself and your patients to arrange to be present during the entire meeting.

It Will Be Well Worth Your While
Make Your Plans For It Now

REDUCED RAILROAD RATES TO THE MINNESOTA MEETING

Reduced Rates Granted to All Members of the American Dental Association Residing in the Western Passenger Association's Territory. It is expected that Several of the Other Passenger Associations will Also Grant This Special Rate.

IMPORTANT RAILROAD INFORMATION

Suggested advice to members of the organization respecting reduction authorized on the certificate plan for benefit of members and dependent members of their families.

A reduction of one and one-half fare on the "Certificate Plan" will apply for members attending the meeting of American Dental Association, Minnesota State Component, to be held at the St. Paul Auditorium, St. Paul, Minnesota, February 6, 7, 8, and 9, 1923, and also for dependent members of their families and Dental Nurses' Association. The arrangement will apply to the following territory.

Western Passenger Association territory:—Minnesota, Montana, North and South Dakota, Illinois, Iowa, Wisconsin, and St. Louis.

The following directions are submitted for your guidance:

1. Tickets at the regular one-way tariff fare for the going journey may be

obtained on any of the following dates (but not on any other date), February 2 to 8 inclusive, 1923. Be sure that, when purchasing your ticket, you request a CERTIFICATE. *Do not make the mistake of asking for a "receipt."*

2. Present yourself at the railroad station for ticket and certificate at least thirty minutes before departure of train on which you will begin your journey.

3. *Certificates are not kept at all stations.* If you inquire at your home station, you can ascertain whether certificates and through tickets can be obtained to place of meeting. If not obtainable at your home station, the agent will inform you at what station they can be obtained. You can in such case purchase a local through ticket and at the same time ask for and obtain a certificate to the place of meeting.

4. Immediately on your arrival at the meeting present your certificate to the endorsing officer, C. H. Turnquist, Secretary, as the reduced fare for the return journey will not apply unless you are properly identified as provided for by the certificate.

5. Arrangements have been made for validation of certificates by a Special Agent of the carriers on Minneapolis, St. Paul, & S. S. M. Ry., St. Paul, Minnesota, February 6 to 13, inclusive, 1923, if the required minimum of 250 certificates is presented.

6. *No refund of fare will be made on account of failure to either obtain a proper certificate nor on account of failure to have the certificate validated.*

7. So as to prevent disappointment, it must be understood that the reduction on the return journey is not guaranteed, but is contingent on an attendance of not less than 250 members of the organization at the meeting and dependent members of their families, holding regularly issued certificates obtained from ticket agents at starting points, showing payment of regular one-way tariff fare of not less than 67 cents on going journey.

8. If the necessary minimum of 250 certificates is presented to the Special Agent as above explained, and your certificate is duly validated, you will be entitled up to and including February 13, 1923, to a return ticket via the same route over which you made the going journey, at one-half of the regular tariff fare from the place of the meeting to the point at which your certificate was issued.

9. Return ticket issued at the reduced fare will not be good on any limited train on which such reduced fare transportation is not honored.

10. Certificates will be honored showing the purchase of going tickets to Minneapolis or St. Paul, Minnesota.

CREIGHTON DENTAL ALUMNI

A special meeting of the Creighton Dental Alumni Association will be held at Omaha, January 23 to 26 inclusive. All alumni and friends are invited to attend this home-coming.

A good program is assured. Privilege will be given to hear some of the leading teachers of the dental science.

NEW JERSEY STATE DENTAL SOCIETY

The New Jersey State Dental Society invites ethical practitioners to meet with them during the fifty-third annual meeting to be held April 11, 12, 13, 1923, in the Stacy-Trent Hotel, Trenton, New Jersey.

The literary program is being arranged by Walton J. Graft, 5 West Park Street, Newark, New Jersey, and the clinics will be in charge of John S. Owens, 109 North Fifth Street, Camden, New Jersey.

Please communicate with the director for convention information, and with the secretary, for other details.

R. S. HOPKINS, *Convention Director*
913 Broad St., Newark, New Jersey.
F. K. HEAZELTON, *Secretary*
223 East Hanover St., Trenton, New Jersey.

REDUCED FARES TO THE CHICAGO COMPONENT MEETING

Fare and one-half on the Certificate Plan has been granted by the Passenger Association to the American Dental Association, Chicago Component meeting. Members of the American Dental Association and dependent members of their families are entitled to this rate. The dates of sale of tickets are from January 15 to 20, and certificates must be presented for return trip not later than January 24.

Pay full fare on going trip and get a certificate from the agent when you purchase your ticket. Then present this certificate to the Validating Officer at the Drake Hotel, Chicago. When a sufficient number (250) have been presented, they will be validated and your certificate entitling you to one-half fare on the return trip, via the same route as going, will be returned to you.

Only certificates issued by the steam lines will be accepted by the Validating Officer.

RESOLUTIONS ON DEATH OF DR. GLENN A. WILGUS

Resolution adopted November 14, 1922 at the regular meeting of the Colorado Prosthetic Club, a copy to be sent to Wife, Mother, Sister and Brother to spread upon the minutes of the Colorado Prosthetic Club, and copies to the several dental journals.

The Colorado Prothetic Club extends to Wife, Mother, Sister and Brother its sincere sympathy in their great loss and hour of trial. May the memory of his many kindly attributes, of his loyal and sincere friendships, of his unswerving devotion to duty ever remain in mute testimony of his life of extreme usefulness and labors well done and be a consolation in their great sorrow.

Respectfully,
R. L. Cristy
E. E. Bailey
Committee.

DENTAL CORPS ORDERS FROM WAR DEPARTMENT

Army

Colonel William H. Chambers from duty in office of attending surgeon, New York City, and will sail on transport to leave New York City about December 22 to Hawaiian Department for duty as assistant to the department surgeon.

Major Joseph H. Tyler having been found by an Army retiring board incapacitated for active service on account of disability incident thereto, his retirement from active service is announced; proceed home.

Captain John A. Rowe, now a patient at Walter Reed General Hospital, D. C., is relieved from duty in Porto Rico and assigned to station at Walter Reed General Hospital.

Captain Roy L. Bodine from duty at Walter Reed General Hospital, D. C., to New York City and sail on transport to leave about December 22 to Hawaiian Department for temporary duty pending the sailing of naval transport Chaumont to leave Honolulu about January 15 for Philippines for duty.

Major Harlan L. Thompson having been found by an Army retiring board incapacitated for active service on account of disability incident thereto, his retirement from active service is announced; proceed home.

Captain Thomas M. Page from duty at Fort Barrancas, Fla., to Fort McPherson, Ga., for duty.

Captain Dell S. Gray relieved from treatment at Walter Reed General Hospital, D. C., from duty at Fort Moultrie, C. C., to Camp Travis, Tex., for duty.

Lieutenant Col. Albert R. White to sail on transport to leave New York City about December 21 for Panama Canal Zone.—*Army and Navy Register*, December 9, 1922.

School of Dentistry

In accordance with the bureau's educational policy, a department of dentistry has been established in the Naval Medical School at Washington, and three dental officers have undertaken special courses of postgraduate study in order that they might be qualified to act as instructors in the dental subjects which have been added to the curriculum of the school. In addition to giving postgraduate instruction to officers of the dental corps, the dental department of the school aims to qualify annually a number of hospital corps men as dental hygienists. These men will work under the supervision of the dental officers and will relieve them of much of the routine cleaning, scaling, and polishing of teeth which has hitherto occupied much of the naval dentist's time, thus keeping him from the exercise of more highly technical dental operations.